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ARCHITECTURE

ENGINEERING

DECORATION

CONSTRUCTION

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Canadian Pacific Railroad Station, Montreal, P. Q.
(Gelatine Print issued only with Imperial Edition.)
Church at Peoria, Ill.
Foyer and Music-Room, New York.
Apartment Building at New York.
Houses at Los Angeles and Santa Monica, Cal.
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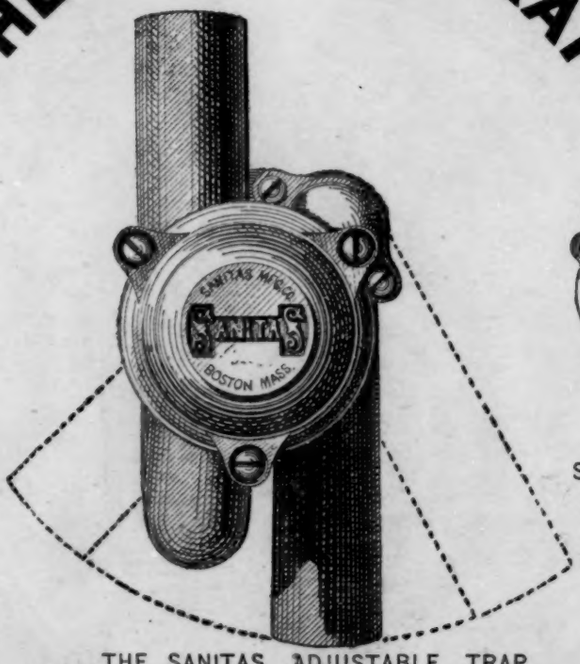

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THE newspapers have already announced the death of M. Alfred-Augustin Durand-Claye, Chief Engineer of the corps of *Ponts-et-Chaussées*, Professor at the School of *Ponts-et-Chaussées* and at the School of Fine Arts, Officer of the Legion of Honor. Although so very distinguished in his profession, M. Durand-Claye was still almost a young man, having been born in 1842. He was educated at the semi-military college of Sainte-Barbe and at the Polytechnic School, from which he graduated with high honor in 1863. Three years later he was commissioned as engineer in the service of the city of Paris, and began those studies of drainage and sewage-disposal which have made his name famous. His earnest wish was to accomplish the drainage of Paris by sewers, after the model of London, abandoning the *fosses*, or vaults, which nearly every house in Paris still contains, and which, in the opinion of most sanitarians, constantly threaten the health of the city. Through his exertions, the change has begun, and it will not be long before a large part, at least, of the better Paris houses will be drained in the English manner, to the great comfort of their inhabitants. As increased drainage involves increased facilities for sewage-disposal, M. Durand-Claye devoted much time to the study of this part of the problem. Fortunately for the people who live in the lower Seine valley, the idea of allowing the sewage of Paris to run directly into the river is now regarded as inadmissible. The present sewers, which carry little except street-wash, discharge upon the irrigation-fields at Gennevilliers, and M. Durand-Claye, who was an ardent believer in sewage-irrigation, planned to extend the system to a larger territory at Saint-Germain. His scheme, although opposed by what the French papers called the almost overwhelming influence of the retail liquor-dealers, has, we believe, been adopted, at least in part, and the experience of Gennevilliers, the most interesting example of sewage-irrigation now in operation, is to be greatly increased in scale.

A CURIOUS trouble has come upon the occupants of the buildings in the lower part of Broadway, in New York, through the operations of the New York Steam Company. This Company, when its main pipes were first laid in the streets, used an expansion-joint packed with putty. Naturally, the putty has, in the course of years, lost its consistency, and it is now found necessary to replace the joints, one by one, with new ones, packed with copper. The change seems to be made in a very leisurely manner, and as the hot steam leaks out meanwhile, the ground in the vicinity is raised to an uncomfortably high temperature. In the present case, a joint having to be made in the Broadway main, the street was opened, and for a week the steam was allowed to pour out of the opening, frightening horses, and heating the basements of the adjoining buildings, before some newspaper reporter called the attention of the officials of the Company to the trouble, only to be coolly told that the repairs would take another week, and that if any person brought suit or injunction against the Company on account of the nuisance, the work would be suspended, and the steam allowed to escape indefinitely. In the good old days of Governor Hoffman, a reply like this would have been followed by the summary occupation of the Company's premises by a company of soldiers, with orders to keep steam shut off until the leak was repaired; but modern governors are not made of such stern stuff, and the unfortunate abuttors have to bear their fate as best they may. According to the reporters, the thermometers in the basements of the neighboring stores range from one hundred and thirty to one hundred and seventy-five Fahrenheit, and the goods stored in them are rapidly spoiling. Moreover, the water in the neighboring mains is so heated that it cannot be pumped in pumps depending on atmospheric pressure, for the reason that steam forms over it as soon as the pressure is lowered by the exhaust, and the water will not rise after the piston. This is rather a serious matter for buildings depending on pumping to get water to the upper stories, and at last accounts some of the property-owners had become desperate, and were about to try whether the courts could not help them.

OUR German brethren have just adopted a new schedule of charges, which supersedes those previously in use, and presents some peculiarities. Like most German documents of the sort, it is rather too long and complicated for the English or American taste, and it is still further complicated by being adapted to the use of engineers, who, in Germany, are always very intimately associated with architects. The most striking peculiarity about the new schedule is the separation of buildings into six classes, the first class comprising barns, stables, plain storehouses and the simplest kind of factories; and, in engineering work, simple embankments of streams, laying out simple systems of water-supply, and roads of ordinary character. The fees to be paid for full professional service in relation to these, including sketches and working-drawings, estimates, general supervision and passing accounts, vary from two per cent on the cost for works involving an outlay of one hundred and fifty thousand dollars or more, to five per cent for those where the expenditure is less than twelve hundred and fifty dollars. The second class comprises the better sort of farm-houses, town-houses of the plainer sort, simple school-houses, almshouses, baths, barracks, prisons, custom-houses, plain railroad-stations, ordinary greenhouses, storehouses for heavy weights, manufactories of a more important kind, and so on; and, for engineering work, simple harbor improvements, canals, exclusive of locks or bridges, drainage and water-supply where no machinery is to be employed, plain, straight bridges up to thirty-three feet span, and railways in level territory. For full professional service in these undertakings the fees range, in inverse proportion to the cost, from three to six and one-half per cent.

THE third class includes all town and country houses requiring a certain amount of artistic skill in design, such as those with ornamental vestibules or staircases, those with stores in the first story, and country-houses with verandas, together with conservatories or decorative greenhouses, handsome stables, temporary exhibition or festival buildings, structures for parks or zoological-gardens, high-school and university buildings, libraries, concert-halls and ball-rooms, theatres, banks, large railway-stations and other public buildings; and, in engineering, foundations, important harbor works, locks and weirs, water-supply for power, drainage and water-supply in general where tunnelling or sinking of shafts is required, pumping-works, drainage of cities, works for the collection, purification and distribution of water or gas, or for the production and distribution of electricity for lighting, building-construction for structures subject to vibration or heavy loads, or requiring roofs of wide span, bridges from thirty-three to one hundred and ninety-five feet span, short and simple tunnels, railways in hilly, marshy or peaty land, rope railways, and difficult highway construction. The designing and supervision of these is to be paid for by fees ranging from four to eight per cent on the cost, the fee for everything costing less than twenty-five thousand dollars being reckoned at more than five per cent.

THIS last class is by far the largest and seems to be regarded as comprising the greater part of the architect's or engineer's commissions. The fourth class includes, for architects, rich city and country dwellings, palaces, churches and

chapels, club-houses, ball-rooms, theatres, town-halls, and other public buildings of a costly character, and for engineers, compressed-air and refrigerating works, docks, slips, dry-docks, dams, bridges of more than one hundred and ninety-five feet span, high aqueducts, drawbridges and bridges of monumental character, long tunnels, mountain railways, and important iron construction for buildings. These demand fees varying from five to nine and one-half per cent, inversely according to cost. The fifth class is only for architects, and includes interior decorations, pavements and parquetry, furniture, fountains, and monuments of all kinds, which are charged for at percentages varying from six to eleven per cent on the cost. The sixth class is only for engineers, and includes the installation of machinery and mechanical works, the fee varying from four and one-half to fifteen per cent.

AN awful explosion occurred last summer at Friedenshutte, in Silesia, the cause of which is still under discussion. Friedenshutte is a town in the mining district, containing great smelting establishments. In the one where the accident occurred, twenty-two large boilers, each about forty feet long, were used to furnish power for driving the blowing-machines, stamp-mills and other apparatus. For the sake of economy, the heated gases from the blast-furnaces were conveyed to the boilers by large tubes, but in order to insure the combustion of the inflammable portion of these gases, the grates of the boilers were kept supplied with burning coal, through which they were forced by the blast. The boilers communicated by means of a large steam drum, and there was a certain amount of communication between the fire-boxes through the branches of the gas supply-pipe. Just after midnight, on the twenty-fifth of July, all the boilers blew up at once, being torn into small pieces, which were thrown to an enormous distance. Twenty-one out of the twenty-two boilers had been tested a year previously, and, although they were old, having been in service for fourteen years, they were proved capable of sustaining a far greater pressure than that indicated by the gauge just before the accident, and stranger still, four out of the twenty-two were not in service, and had no fire under them, yet these were blown up like the rest. The inquest failed to throw much light on the matter, and a commission of experts was appointed, which has just published a curious report, quoted in the *Revue Industrielle*. All the evidence showed that the steam-pressure was not excessive, and that the water-gauges had been looked after, so the commission decided that the catastrophe could not be attributed either to steam-pressure or low water. It appeared, however, that just before the explosion several of the boilers had been fed with coal, moistened, as such coal often is, by sprinkling with water. In the judgment of the experts, the overloading of several grates at once with cold, moist coal, had had the effect of cooling the furnace gas temporarily below the point of combustion, leaving it, however, at a temperature high enough to distil the coal. In consequence of this, an immense volume of unconsumed carbonic oxide from the blast-furnaces, mixed with hydro-carbons from the coal on the grates, was poured into the fire-boxes and flues of some of the boilers, spreading by diffusion into the others, and mixing everywhere with air enough to form a dangerously-explosive compound. As soon as it found its way to the boilers where the fire was still bright, detonation took place, with the intensity and destructiveness characteristic of gas-explosions.

A NEW idea has been developed in Germany, in the shape of the manufacture of mortar, to be sold at retail to small builders and private individuals. The business requires very little capital, and the mortar, which is mixed by machinery, and of excellent quality, finds a ready sale, something like two million barrels having been disposed of last year in Berlin alone. It is rapidly becoming usual for city builders, here as elsewhere, instead of maintaining large yards, at enormous rents, for the storage of materials, to keep only an office, contracting for their bricks, lime, cement, doors, lumber, glass and so on, to be delivered at the building where they are to be used. This involves the manufacture of mortar on the ground, under unfavorable circumstances, and at an unnecessary expense; and a provision by which, on dropping a card into a box, or speaking a word through a telephone, a suitable quantity of first-rate mortar for any purpose, ready for use, could be delivered at an hour's notice where required, seems likely to be very useful. We use mortar containing a portion of cement with a freedom unknown abroad, and of course this could not be kept long on hand; but there would be no difficulty in taking the quantity required from a stock of lime mortar, adding the desired dose of cement, and running the mixture through a mill, turning it out in excellent condition. For householders, plasterers, carpenters, steam-fitters, furnace-men, and others who have occasion to use small quantities of mortar or cement, it could easily be supplied in cans or water-tight boxes, and all architects know that mortar honestly made in this way, and kept in stock, would be far superior in quality to that now generally employed in building.

THE *Builder* gives some statistics of the rate of wages in New South Wales, quoted from a report of the Immigration Agent at Sydney, which are worth comparing with similar statistics for our own country. In many respects the condition of the Australian colonies resembles that of our Western and Southwestern States. In both the population is rapidly increasing, and needs houses to live in, and in both the state of society is simple, and the employments incidental to an old and complex civilization hardly exist. The only profession of this class which has reached a high state of development in New South Wales seems to be that of the law, and, according to the Immigration Agent's report, the supply of legal talent in the colony is very large, exceeding the demand, in fact, so that the Agent does not advise lawyers to come there unless they have already an acquaintance in the country. Surgeons and physicians are already plenty, but, as he says, good aurists and other specialists could find remunerative employment. As in nearly all new countries, there has been a great immigration of young business men, book-keepers, clerks, salesmen and so on. The best of these have long ago occupied all the available situations, and there is no mercantile work left for the rest to do. The only field for skilled industry which seems to show no sign of being fully occupied is that which comprises the building trades, and experienced masons, bricklayers, carpenters and joiners can always find employment. In all the building trades the working day consists of eight hours, and carpenters, plumbers, painters and gas-fitters get, on an average, two dollars and a half a day; bricklayers and plasterers about three dollars, and laborers from two to two and a half.

THE great Russian railway grows so fast that from month to month it seems to take in a new province. A few weeks ago it had penetrated a hundred miles or so from the Caspian Sea into the barbarous country of the Turkomans. Now it has crossed from end to end the country which, since the beginning of history, has been the possession of independent tribes of robbers, and, passing through their capital, Bokhara, has reached Samarcand, close to the great plateau known as the "roof of the world," and within about three hundred miles of the Chinese frontier. Under General Annenkoff, whose energy and ingenuity in overcoming obstacles have made him famous, the road has advanced with a rapidity which obscures the achievements even of the Canadian Pacific engineers, and the Russians, not content with a railway extending through fifty degrees of longitude from St. Petersburg, already talk of building through sixty degrees more, to Vladivostock, on the Pacific Ocean. As there would be a difference of seven hours in time between the ends of the line, it would be interesting to know, in this case, what would be taken as the meridian for setting the railroad clocks. So far, according to M. Barré, who writes occasional notes on the subject to *La Semaine des Constructeurs*, the line is exclusively military, but it will probably soon be opened to the public, and the tourist or the merchant will then be able to leave Paris or London on Monday morning, and by the following Monday night be in China or in India, after passing through a succession of the most curious countries in the world. With the railway and the Russian administration have come peace and prosperity to the Asiatic plains, which have been continuously ravaged by bands of robbers since the time of Xenophon. Merv, which was lately a walled citadel, containing about three thousand turbulent inhabitants, in the middle of a desert in which no one but a robber could live, is already an important town, surrounded by a vast area of gardens, fields and pastures, effectually and, we may hope, permanently defended by Russian rifles and tranquillized by Russian administration.

SAFE BUILDING.—XXVII.[1]

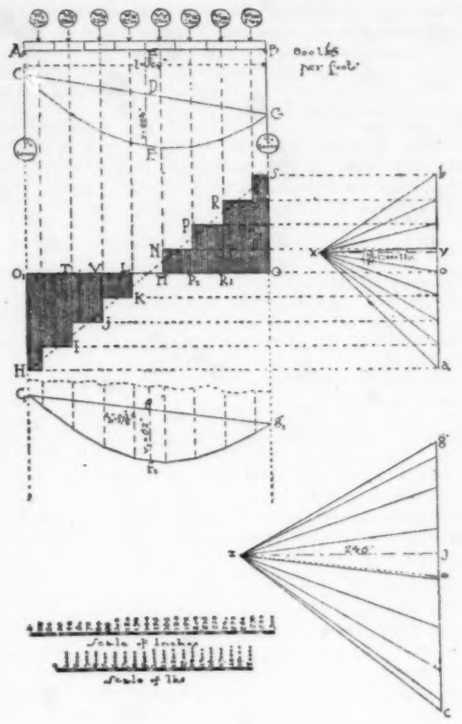


Fig. 156.

Example VI.

Uniform Load. *A wrought-iron beam of 25-foot span (Figure 156) carries a uniform load of 800 pounds per running foot of beam, including weight of beam. The beam is thoroughly braced sideways. What beam should be used?*

We draw $A\,B = 300''$ at inch scale, and then divide our uniform load into a number of equal sections, say eight, each

$$l_1 = \frac{300}{8} = 37\tfrac{1}{2}'' \text{ long.}$$

The total load on beam is

$$u = 25.800 = 20000 \text{ pounds.}$$

Each section therefore carries:

$$\frac{u}{8} = \frac{20000}{8} = 2500 \text{ pounds.}$$

We place our arrows w_1, w_{11}, etc., at the centre of each section, which will bring the end ones at $\frac{l_1}{2}$ distant from each support, so that these same verticals will answer when obtaining deflection figure.

We now make $b\,a = 20000$ pounds at pound scale, and divide it into eight equal parts, each equal $w_1 = w_{11} = w_{111}$ etc., $= 2500$ pounds. We make $x\,y = 12000$ pounds, which is the $\left(\frac{k}{f}\right)$ for wrought-iron, see Table IV. We draw $x\,b$, $x\,a$, etc., and construct figure $C\,E\,G$, which will approach a parabola in outline. The more parts we take the nearer will it be to a parabola.

We draw $x\,o$ parallel $C\,G$ and find it bisects $b\,a$, or each reaction is one-half the load or $= 10000$ pounds. This we know is the case. The longest vertical will, of course, be at the centre D of $C\,G$, or greatest bending-moment will be at the centre, this we know is the case. $D\,E$ scales (inch scale) $62\frac{1}{2}''$ which will be the *required* r or moment of resistance (Formula 92). The bending-moment at the centre will be, Formula (93).

$$m = 62\tfrac{1}{2}.\ 12000 = 750000$$

Had we used Formula (21) we should have had

$$m = \frac{20000.\ 300}{8} = 750000 \text{ or same result, and from Formula (18) for}$$

$$r = \frac{750000}{12000} = 62\tfrac{1}{2} \text{ also the same as before. From}$$

Table XIX we find the nearest r to our required r (62,5) is 69,8 which calls for a $15'' - 150$ pounds beam; as the beam is braced sideways this will do, if sufficiently stiff.

In regard to shearing, we draw the figure $O_1\,H\,I\,J\,K\,L\,M\,N\,P\,R\,S\,O$ and find shearing on both sides of beam similar, increasing gradually from the centre to ends.[2]

It would be:

Cross shearing from A to $w_1 = O_1\,H = 10000$ pounds.
Cross shearing from w_1 to $w_{11} = T\,I = 7500$ pounds.
Cross shearing from w_{11} to $w_{111} = V\,J = 5000$ pounds.
Cross shearing from w_{111} to $w_{1v} = L\,K = 2500$ pounds.
Cross shearing from w_{1v} to $w_v = O\ \ = 0$ pounds.
Cross shearing from w_v to $w_{v1} = M\,N = 2500$ pounds.
Cross shearing from w_{v1} to $w_{v11} = P\,P_1 = 5000$ pounds.
Cross shearing from w_{v11} to $w_{v111} = R\,R_1 = 7500$ pounds.
Cross shearing from w_{v111} to $B = S\,O = 10000$ pounds.

The area of web of a $15'' - 150$ pounds beam (Table XIX) is 7,59 square inches; the safe resistance of wrought-iron to cross-shearing per square inch being $\left(\frac{g}{f}\right) = 8000$ pounds, we need not worry any further on that score.

To find the deflection we now make the lower load line $g\,c$ equal to the sum of the lengths of verticals $w_{v111}, w_{v11}, w_{v1}$ etc., through parabola $C\,E\,G$, beginning at top g with length of right vertical w_{v111}. We select z at random, scale $z\,j = 246''$ (inch scale), draw $z\,g, z\,c$, etc., and figure $c_1\,f_1\,g_1$. We now draw $z\,o$ parallel $c_1\,g_1$ and find it bisects $g\,c$, or greatest deflection will be at centre of beam, which we know is the case. We scale $f\,f_1 = 62''$ (inch scale); find from Table XIX for our $15'' - 150$ pounds beam $i = 523,5$ and from Table IV for wrought-iron $e = 27000000$, therefore, Formula (95):

$$\delta = \frac{62.37,\ 5.\ 246.\ 12000}{27000000.523,5} = 0,486''$$

Had we figured arithmetically, Formula (39), we should have had

$$\delta = \frac{5.\ 20000.\ 300^3}{384.27000000.\ 523,5} = 0,497''$$

or practically the same result.

The safe deflection for plastering should not exceed (28)

$$\delta = 25.\ 0,03 = 0,75''$$

so that we are perfectly safe, providing our beam is well braced sideways.

Example VII.

Uniform and Concentrated Load. *A wrought-iron beam, braced sideways, of 30-foot span, Figure 157, carries a uniform load of 200 pounds per foot, including weight of beam. It carries also a concentrated load $w_1 = 10000$ pounds ten feet from the right-hand support. What beam should be used?*

We draw beam $A\,B = 360''$ at inch scale, we divide uniform load into, say, six equal parts, each 5 feet long, or $l_1 = 60''$. The total uniform load will be $u = 30.200 = 6000$ pounds, therefore each part $\frac{u}{6} = \frac{6000}{6} = 1000$ pounds. We draw arrows at the centre of each uniform part, so that the end arrows will be one-half part from supports. These arrows will therefore answer for our verticals, when drawing deflection figure.

At $120''$ from right hand support we locate the load $w_1 = 10000$ pounds.

We now make load line $b\,a = 16000$ pounds the total load and divide it, so that

$$b\,l = w_{v11} = 1000 \text{ pounds.}$$
$$l\,h = w_{v1} = 1000 \text{ pounds.}$$

[2] Had we taken more parts, the steps in shearing figure would become smaller and smaller till they would finally assume the straight line $H\,S$, which is the real outline of shearing figure.

GLOSSARY OF SYMBOLS.—The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.:—

a = *area*, in square inches.
b = *breadth*, in inches.
c = constant for *ultimate resistance to compression*, in pounds, per square inch.
d = *depth*, in inches.
e = constant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
f = *factor-of-safety*.
g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
g_1 = constant for *ultimate resistance to shearing*, per square inch, lengthwise of the grain.
h = *height*, in inches.
i = *moment of inertia*, in inches. [See Table I.]
k = *ultimate modulus of rupture*, in pounds, per square inch.
l = *length*, in inches.
m = *moment or bending moment*, in pounds-inch.
n = *constant* in Rankine's formula for compression of long pillars. [See Table I.]
o = the *centre*.
p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
q = the *amount* of the *right hand re-action* (or support) of beams, in pounds.
r = *moment of resistance*, in inches. [See Table I.]
s = *strain*, in pounds.
t = constant for *ultimate resistance to tension*, in pounds, per square inch.
u = *uniform load*, in pounds.
v = *stress*, in pounds.
w = *load at centre*, in pounds.
x, y and z signify *unknown quantities*, either in pounds or inches.
δ = *total deflection*, in inches.
ρ^2 = *square of the radius of gyration*, in inches. [See Table I.]
$\mathfrak{d}$ = *diameter*, in inches.
$\mathfrak{r}$ = *radius*, in inches
$\pi = 3.14159$, or, say, 3 1-7 signifies the *ratio of the circumference and diameter of a circle*.

If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, a_{11}, a_{111}, etc., or b, b_{11}, b_{111}, etc.

In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance:—

m = moment or bending moment at *centre*.
m_A = " " " *point A.*
m_B = " " " *point B.*
m_X = " " " *point X.*
s = strain at *centre*.
s_B = " *point B.*
s_X = " *point X.*
v = stress at *centre*.
v_D = " *point D.*
v_X = " *point X.*
w = load at *centre*.
w_A = " *point A.*

[1] Continued from No. 649, page 259.

$h f = w_{\text{I}} = 10000$ pounds.
$f e = w_{\text{II}} = 1000$ pounds.
$e d = w_{\text{IV}} = 1000$ pounds.
$d c = w_{\text{III}} = 1000$ pounds.
$c a = w_{\text{II}} = 1000$ pounds.

Select pole x distant from load line at random (for the sake of illustration, though it would be better to make $x y = \left(\frac{k}{f}\right) = 12000$ pounds.) We find $x y$ scales 6500 pounds. We now draw $x b, x l, x h, x f$,

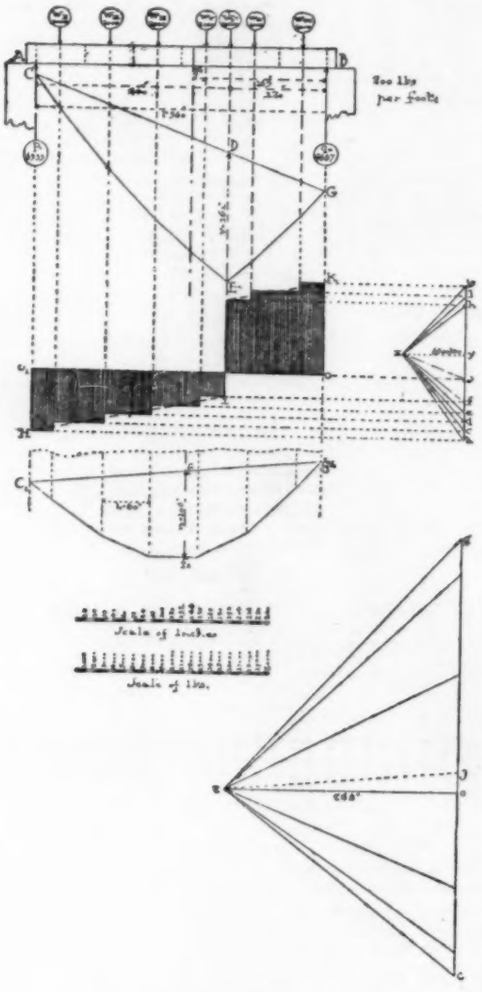


Fig. 157.

etc. And construct figure $C E G$. Draw $x o$ parallel $C G$ and we find $a o$ (or reaction A) scales = 6333 pounds, and $o b$ (or reaction B) scales = 9667 pounds.

The longest vertical is $D E = 161''$ (inch scale) therefore greatest bending-moment is at w_{I} and from Formula (93)

$$m_{w_{\text{I}}} = 161.6500 = 1046500$$

For the *required* moment of resistance we have from Formula (18)

$$r = \frac{1046500}{12000} = 87{,}2$$

The *cheapest* or most economical nearest section we find — to this required r (87,2) is the 20″ — 200 pounds beam of which the moment of resistance is $r = 123{,}8$.

Had we combined the formulæ for uniform and concentrated loads and worked out the problem arithmetically it would have been tedious, but we should have had similar results.

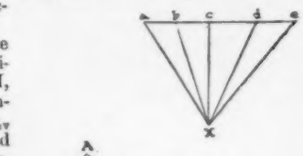
We can safely overlook shearing, but note that the real shearing figure would not be the shaded figure, but dotted figure $O_1 H I J K O$.

For finding the deflection we now draw lower load line $g c =$ the sum of the verticals through $C E G$, beginning at top with length of w_{VI}, then w_{VI}, w_{V}, w_{IV}, w_{III}, and w_{II} in their order. We take no notice of vertical w_{I} as it does not fall in one of the even divisions of $C G$ or $A B$ into lengths l. We select pole z distant $z j = 288''$ from load line, draw $z g$, $z c$, etc., and then figure $c_1 f_1 g_1$. We now draw $z o$ parallel $c_1 g_1$ it divides $g c$, so that $g o = 295''$ and $o c = 245''$, we divide $c_1 g_1$ in same proportion at f, and carry this up to F at beam, which is the point of greatest deflection of beam, and is distant 163″ from B, and 197″ from A. We scale $f f_1 = 106''$ (inch scale) and have from Formula (97)

$$\delta = \frac{106.60.288.6500}{27000000.1238} = 0{,}357''$$

1238 being $= i$, the moment of inertia of beam as found in Table XIX. The beam is therefore amply stiff even to carry plastering.

Irregular Cross-sections. The graphical method lends itself very readily to finding centres of gravity and neutral axes, as explained in the chapter on arches, and also for finding the moments of inertia of difficult cross-sections.



To find Neutral Axis. If we have an irregular figure $A B C D E$ (Figure 158) we divide it into simple parts I, II, III and IV. We find the centres of gravity g_{I}, g_{II}, g_{III} and g_{IV} of each part and draw their respective horizontal neutral axes through these. Anywhere's make a line $a e =$ area of whole figure and divide it, so that:

$a b =$ area of I
$b c =$ area of II
$c d =$ area of III and
$d e =$ area of IV.

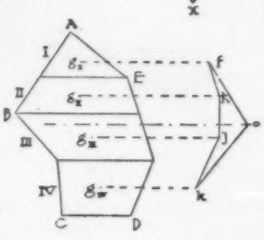


Fig. 158.

Select pole x at random, draw $x a$, $x b$, $x c$, $x d$, and $x e$.

From any point of horizontal g, draw $f h$ parallel $b x$ till it insects horizontal g_{II}; then draw $h j$ parallel $c x$ to horizontal g_{III}; then $j k$ parallel $d x$ to last horizontal, and finally $k o$ parallel $x e$; and $f o$ parallel $a x$ till they intersect at o. A horizontal through o is the main neutral axis of the whole.[1]

To find Moment of Inertia. If we multiply the area of the figure $f o k j h$ by the area of the figure $A B C D E$ (both in square inches) we have the value of moment of inertia i of $A B C D E$ in inches, around its horizontal neutral axis o.

To find area. A simple way of obtaining the area of the figure $f o k$ would be to draw horizontal lines through it at *equal* distances, beginning with half distances at *top* and bottom, and to multiply the sum of these horizontals in length by the distance apart of any two horizontals, all measurements in inches. This will approximate quite closely both the area and moment of inertia. Of course the more parts we take in all of the processes, the closer will be our result.

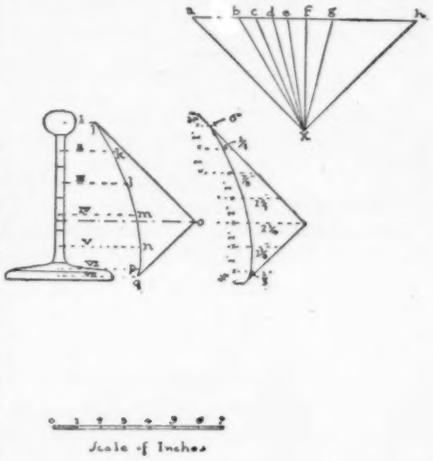


Fig. 159.

A practical example will more fully illustrate the above.

Example VIII.

Rolled Deck-beam. *Find horizontal neutral axis and the corresponding moment of inertia of a 7″ — 55 pounds per yard deck beam, resting on its flat flange* (*Figure* 159).

We will take the roll as one part, divide the web into four equal parts, the flange into two parts, one the base which will be practically rectangular, and its upper part which will be practically triangular. The whole area we know is for wrought-iron:

$$a = \frac{55}{10} = 5{,}5 \text{ square inches.}$$

The bottom rectangular part of flange will be

$$a_{\text{VII}} = 4\tfrac{1}{2} . \tfrac{3}{8} = 1{,}7 \text{ square inches}$$

next triangular part

$$a_{\text{VI}} = \frac{4\frac{1}{2} . \frac{3}{8}}{2} = 0{,}9$$

The web parts

$$a_{\text{II}} = a_{\text{III}} = a_{\text{IV}} = a_{\text{V}} = \frac{\frac{5}{16} . 5\frac{1}{4}}{4} = 0{,}4 \text{ square inches each.}$$

Leaving for the roll at top $a_{\text{I}} = 1{,}3$

We now make the horizontal line $a h = 5{,}5''$ and divide it, so that

$a b = 1{,}3$ inches
$b c = c d = d e = e f = 0{,}4$ inches

[1] The point of intersection of this line with a main neutral axis, found similarly, in any other direction, would be the centre of gravity of the whole figure.

$f g = 0{,}9$ inches and
$g h = 1{,}7$ inches.

Select x at random and draw $x a$, $x b$, $x c$, etc.

Draw the horizontal neutral axes I, II, III, etc., through their respective parts. Begin anywhere on I and draw $j k$ parallel $b x$ to line II; then $k l$ parallel $c x$ to III; then $l m$ parallel $d x$ to IV; then $m n$ parallel $e x$ to V; then $n p$ parallel $f x$ to VI; then $p g$ parallel $g x$ to VII; Now draw from q the line $q o$ parallel $x h$, and from j the line $j o$ parallel $a x$ till they intersect at o. A horizontal through o is the neutral axis of whole beam. We will now make a new drawing of figure $j o q$ for the sake of clearness. Draw horizontals through it every inch in height beginning at both top and bottom with one-half inch. The top one scales nothing, the next $\frac{1}{8}''$, then $\frac{7}{8}''$, then $1\frac{1}{2}''$, then $2\frac{1}{4}''$, then $1\frac{3}{4}''$, and the bottom one $\frac{1}{4}''$, the sum of all being $6\frac{5}{8}''$ or $6{,}416''$. This multiplied by the height of the parts, which is one inch, would give us, of course, 6,416 square inches area. Multiplying this area by the area of the cross-section of deck beam 5,5 square inches, we should have

$$i = 5{,}5 . 6{,}416 = 35{,}288.$$

In Table XIX it is given as 35, 1 so that we are not very far out.

If we had taken more parts, of course the result would have been more exact.

Horizontal Neutral Axis.

Area of Diagram.

Moment of Inertia of Beam.

Reducing Flanges, Plate Girders. When constructing plate girders of large size, much material can be saved by making the flanges heaviest at the point of greatest bending-moment, and gradually reducing the flanges towards the supports.

This is accomplished by making each flange at the point of greatest bending-moment of several thicknesses or layers of iron, the outer layer being the shortest, the next a little longer, etc. Of course the angles, which form part of the flange are kept of uniform size the whole length, as it would be awkward to attempt to use different sized angles. Generally (though not necessarily) the inner or first layer of the flange plates, is also run the entire length. Of course, where the flanges are gradually reduced in this way, it becomes necessary to figure the bending-moment and moment of resistance at many points along the plate girder to find where the plates can be reduced. This would be a wearisome job. By using the graphical method, however, it can be easily accomplished. Referring back to Figure 151, we take the point of greatest bending-moment (at w,) of the beam A B. The required moment of resistance at this point, it will be remembered was the length (inch scale) of vertical E through C D E F G. We now decide what size angles we propose using and settle the necessary thickness of the flanges by Formula (36), inserting for the value of r, the length (inch scale) of v or vertical at E. Further a, will, of course, be the sum of the area of two angles, d the total depth of girder in inches and b the breadth of flange, in inches, less rivet holes. The above is on the assumption that the distance $x y$ of pole x from load line $d a$ was equal to the safe modulus of rupture $\left(\frac{k}{f}\right)$ of steel or wrought-iron according to whichever material we were using, or we should have:

Thickness of Flanges.

$$x = \frac{\frac{v}{d} - a_1}{b} \qquad (98)$$

Where x = the thickness, in inches, of each flange of a plate girder at any point of its length.

Where v = the length of vertical, inch scale, through upper or resistance figure, providing we have assumed the distance of pole from load line (pound scale) $= \left(\frac{k}{f}\right)$ of the material.

Where d = the total depth, in inches, of the plate girder.

Where b = the width, less rivet holes, in inches, of the flange.

Where a_1 = the sum of the areas of cross-section, in square inches, of *two* of the angles used.

We now calculate as above, the thickness x of flange at point of greatest bending-moment and then decide into how many layers or thicknesses we will divide the flanges. Say, in our case we decide to make the flange of four layers of plates, each $\frac{x}{4}$ or one quarter x in thickness. Then make

$$E_1 E_{11} = a_1 . d \qquad (99)$$

Where $E_1 E_{11}$ = the amount to be substracted (inch scale) from moment of resistance or vertical v and representing the work of two angles.

Where a_1 = the sum of the area of cross-section, in square inches, of the two angles.

Where d = the total depth, in inches, of the girder.

Where to drop off Plates. Now draw through E_{11} a parallel to base of figure C G, divide $E_{11} E$ into as many parts as we decide to use thicknesses of plates (four in our case) and draw parallel lines to base C G through these parts. Vertically over the points where these lines intersect the curve or outline of figure C D E F G will be the points at which to break off plates, as illustrated in drawing. This method, of course, is approximate, but it will be found sufficiently accurate for all practical purposes. It is not necessary that x or E E_{11} be divided into equal parts. Had we decided to use plates of varying thicknesses we should simply divide E E_{11} in proportions to correspond to thicknesses of plates *in their proper order*, beginning at E_{11} with plate immediately next to angles and ending at E with extreme central outside plate. An example, more fully illustrating the above, will be given in the chapter on plate girders.

LOUIS DE COPPET BERG.

EARLY SETTLER MEMORIALS.[1]—XIV.

VAN WART MONUMENT.

New Monument to Paulding at Tarrytown.

IN 1829, the citizens of Westchester County, N. Y., erected, in the graveyard attached to the Presbyterian church at Greenburgh, a monument to the memory of Van Wart. It is inscribed as follows: "Here repose the mortal remains of Isaac Van Wart, an elder in the Greenburgh Church, who died on the 23d of May, 1828, in the 69th year of his age. Having lived the life, he died the death of the Christian.

"The citizens of the County of Westchester erected this tomb in testimony of the high sense they entertained for the virtuous and patriotic conduct of their fellow-citizen, as a memorial sacred to public gratitude.

"*Vincit Amor Patriæ.* Nearly half a century before this monument was built, the conscript fathers of America had, in the Senate Chamber, voted that Isaac Van Wart was a faithful patriot, one in whom the love of country was invincible, and this tomb bears testimony that the record is true.

"Fidelity. On the 23d of September, 1780, Isaac Van Wart, accompanied by John Paulding and David Williams, all farmers of the County of Westchester, intercepted Major André on his return from the American lines in the character of a spy, notwithstanding the large bribes offered them for his release, nobly disdained to sacrifice their country for gold, secured and carried him to the commanding officer of the district, whereby the dangerous and traitorous conspiracy of Arnold was brought to light, the insidious designs of the enemy baffled, the American army saved and our beloved country free."

OLD PAULDING MONUMENT AT TARRYTOWN.

In May, 1853, a public meeting was held in Tarrytown, N. Y., "for the purpose of considering the propriety of erecting a monument commemorative of the capture of André." This meeting grew out of a fear that the actual ground where the event took place would become a matter of dispute, because of the natural and artificial changes in the topography of the locality incident to improvements, as well as "the very proper desire to put up in what was the

[1] Continued from No. 649, page 264.

most beautiful region on the river some work of art that would embellish and commemorate an historic spot." Besides, the capture of André had become the common property of the world in poetry, history and art, the subject of romances, and the favored theme of orators and statesmen. The locality itself had become a trysting place, a kind of Mecca for English visitors.

The purpose of the above meeting was really to accept the propositions of the Inspectors of State Prisons, "to furnish a suitable monument for the commemoration of the capture of André, properly inscribed, provided the citizens of Tarrytown and the County of Westchester would erect the same and keep it in repair," and that of Mr. Taylor, "who agreed to give the necessary land for the site of the monument, a plot of twenty feet square." After accepting these gifts, the meeting appointed a committee of twenty-seven members, whose duties were to collect money "to build a firm and desirable base or foundation for the monument, to enclose the same with an iron railing, and to pay the expenses attending the laying of the corner-stone and the dedication."

The corner-stone was laid on the 4th of July following and the dedication of the structure took place on the 7th of October. Both occasions were attended by large numbers of military and civic bodies and distinguished citizens of the State. On the first occasion, the oration was delivered by Hon. James T. Brady. On the second, the opening address was made by Governor Horatio Seymour, who, in a long speech, in which he dedicated the monument and declared his great interest in the subject that brought them together, did not even mention the names of André's captors. The oration was delivered by Hon. Henry J. Raymond and was in every respect a complete and noble effort. In it he spoke of Nathan Hale, and, for the first time since this noble martyr went to his unknown grave, was the voice of one of his countrymen fitly raised in his behalf.

The monument is made of Sing-Sing marble. On one side of the die are cut these words: "Their conduct merits our warmest esteem. They have prevented, in all probability, our suffering one of the severest strokes that could have been meditated against us."—*Washington.*

On the other side is the following: "On this spot, the 23d day of September, 1780, the spy, Major John André, Adjutant-General of the British Army, was captured by John Paulding, David Williams and Isaac Van Wart, all natives of this county. History has told the rest. The people of Westchester County have erected this monument as well to commemorate a great event as to testify their high estimation of that integrity and patriotism which, rejecting every temptation, rescued the United States from most imminent peril, by baffling the arts of a spy and the plots of a traitor. Dedicated October 7, 1853."

MONUMENT TO DAVID WILLIAMS.

David Williams moved from Westchester County to the town of Livingstonville, Schoharie County, in 1806, and died there in 1831. He was buried with military honors and followed to his grave by a large concourse of people. For several successive years Judge Murphy, his god-son, visited Washington and urged Congress to erect a fitting monument to the captor's memory, but he appealed to deaf ears. On the 4th of March, 1876, the remains of Williams were removed to the cemetery of Rensselaerville, and on the 19th of July of the same year they were again removed to the old Stone Fort at Schoharie Court-House, escorted by a large procession.

On the 1st of May, 1876, the Legislature of the State of New York appropriated the sum of two thousand dollars for the purpose of "erecting a suitable monument in the cemetery grounds of the Revolutionary Stone Fort at Schoharie Court-House to commemorate the virtues and memory of David Williams, one of the captors of Major André, to be expended under the supervision of Daniel Knower, Ralph Brewster and Judge Charles Holmes." This appropriation was also opposed by a member who gave the same reasons for his action that were used by Major Tallmage in Congress in 1817.

These commissioners issued the following inviting appeal "to any county, city, association, literary club, or individual, who may subscribe not less than two hundred or more than eighteen hundred dollars in addition to the two thousand appropriated by the State, shall have their names inscribed on one of the faces of the monument or on a marble tablet to be erected in the Fort, as the artists who may design the monument may think most appropriate. It is proposed to appoint one or more of the most distinguished artists and sculptors in the State to design the monument and make it a work of art appropriate to the event." This tempting statement did not touch the hearts of the people of Schoharie County, and the commissioners erected "a plain monument."

The ceremonies of laying the corner-stone took place on September 23, 1876, the ninety-sixth anniversary of the capture of André. They were attended by the usual presence of military and civic organizations, many distinguished citizens, two grandsons of Williams, and many of his descendants. The oration was delivered by Mr. Grenville Tremain of Albany.

A book, called the "*Centennial Celebrations of the State of New York,*" for which the State appropriated five thousand dollars, contains the following description of the monument, furnished by Mr. Knower. "It is a fine block of Massachusetts marble, and the work is artistically executed. The height of the monument is twenty-three feet and nine inches. The following inscriptions, the production of Mr. Knower himself, are engraved on the monument:

"HERE REST THE REMAINS OF
DAVID WILLIAMS,
ONE OF THE CAPTORS OF
MAJOR ANDRÉ.
DIED IN SCHOHARIE COUNTY
AUG 2D 1831
AGED 76 YEARS, 6 MOS, 8 DAYS.

"He with his compatriots, John Paulding and Isaac Van Wart, on the 23d of September, 1780, arrested Major John André and found on his person treasonable papers in the handwriting of General Benedict Arnold, who sought by treachery to surrender the military Post of West Point into the hands of the enemy. In resisting the great bribes of their prisoner for his liberty, they showed their incorruptible patriotism. The American army was saved and our beloved country became free.

"FIDELITY.

"By authority of Congress, 1780, a silver medal was voted to them, and presented to the captors by General Washington, at a dinner to which he invited them while the army was encamped near Verplank's Point.

"VINCIT AMOR PATRIAE.

"General Washington's letter to the President of Congress, October, 1780: 'The party that took Major André acted in such a manner as does them the highest honor and proves them to be men of great virtue.'

"NANCY BENEDICT
WIFE OF
DAVID WILLIAMS
DIED AUG. 5, 1844, AGED 87 YRS. 6 MS. 8 DS.

"This monument was erected by the State of New York from an appropriation made in the Centennial year of 1876, by a bill introduced by Senator W. C. Lamont, under the following State Commissioners: Daniel Knower, Ralph Brewster and Charles Holmes."

And thus will the memory of David Williams go down to posterity in the Stone Fort at Schoharie Court-house.

In the fall of 1830, the corporation of the city of New York invited Williams, the survivor of the three, by special messenger, to be present in that city at the celebration of the French Revolution. He was drawn, with other heroes of 1776, in a carriage at the head of the procession and attracted much attention. At one of the schools he visited he was presented with a silver cup, and at another with a silver-headed cane, the stem of which was made out of a *chevaux de frise* used at West Point during the Revolution.

NEW PAULDING MONUMENT AT TARRYTOWN.

The public meeting, before mentioned, that was held in Tarrytown in May, 1853, for the purpose of accepting the proposed gift of a monument to John Paulding, and to provide means for the expense of laying the corner-stone and dedicating the monument, was the first effort towards the organization of the "Monument Association of the Capture of André."

It was incorporated in November, 1879, agreeably to the laws of the State of New York. In the early part of 1879, the Association determined to celebrate the one hundredth anniversary of the capture of André, and to erect a "bronze statue," because the "original plan" of a monument to Paulding, "was felt to be inadequate at the end of twenty-seven years." To accomplish these objects, the Association procured from the State, through the efforts of Hon. D. O. Bradley, the sum of one thousand dollars, and two hundred and seventy persons, gave five thousand four hundred and fifty-four dollars more.

The Association went seriously to work to provide for the success of the dedicatory ceremonies, by appointing eighty-six vice-presidents, forty-seven committee-men, and twenty secretaries. It invited, by the thousands, the most distinguished citizens of the United States to be present on the occasion, besides a large number of military and civic organizations. An immense procession preceded the exercises, and all thousands thus gathered together, met on Mount André, under a great tent, on the morning of the 23d of September, 1880, to do honor to the three captors and unveil a statue of Paulding.

They were made happy and patriotic by music from Gilmore's band; by "a brilliant floral display, consisting of geraniums, tuberoses and other flowering plants;" by the cool breeze from the majestic Hudson, and burning words of grateful tribute to the virtuous dead from silver-tongued orators.

The exercises were opened by an address from the President of the day, Hon. Samuel J. Tilden, followed by a prayer by Rev. Alexander Van Wart, the aged son of one of the captors.

Mr. Orlando B. Potter then read an historical paper.

The oration was delivered by Hon. Chauncey M. Depew. If not as brilliant and inspiring as that delivered twenty-seven years before, by Hon. Henry J. Raymond, at the same place on a like occasion, it was an extremely interesting and valuable contribution to the literature of the event. Nor did the orator neglect the forgotten life and deeds of Nathan Hale.

The new monument, thus imposingly dedicated is "a rejuvenation and elaboration of the old one," with the addition of a bronze statue

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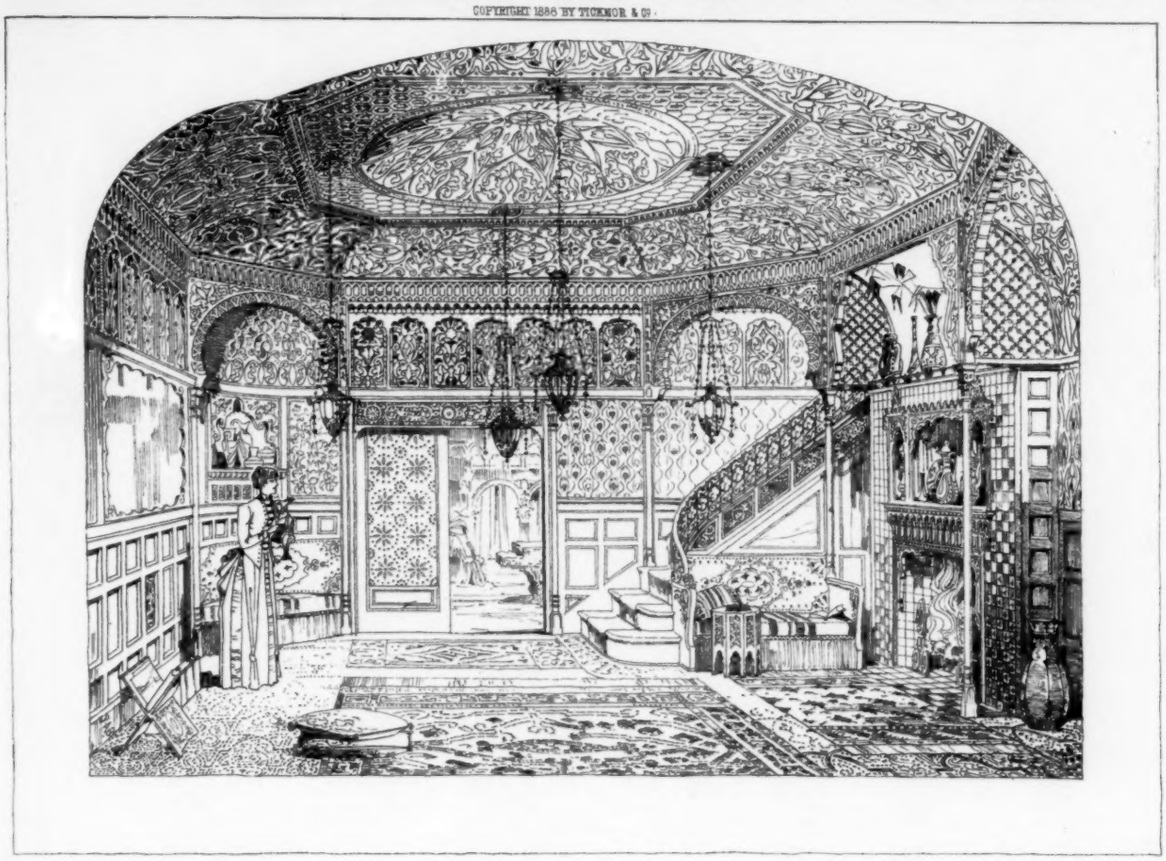

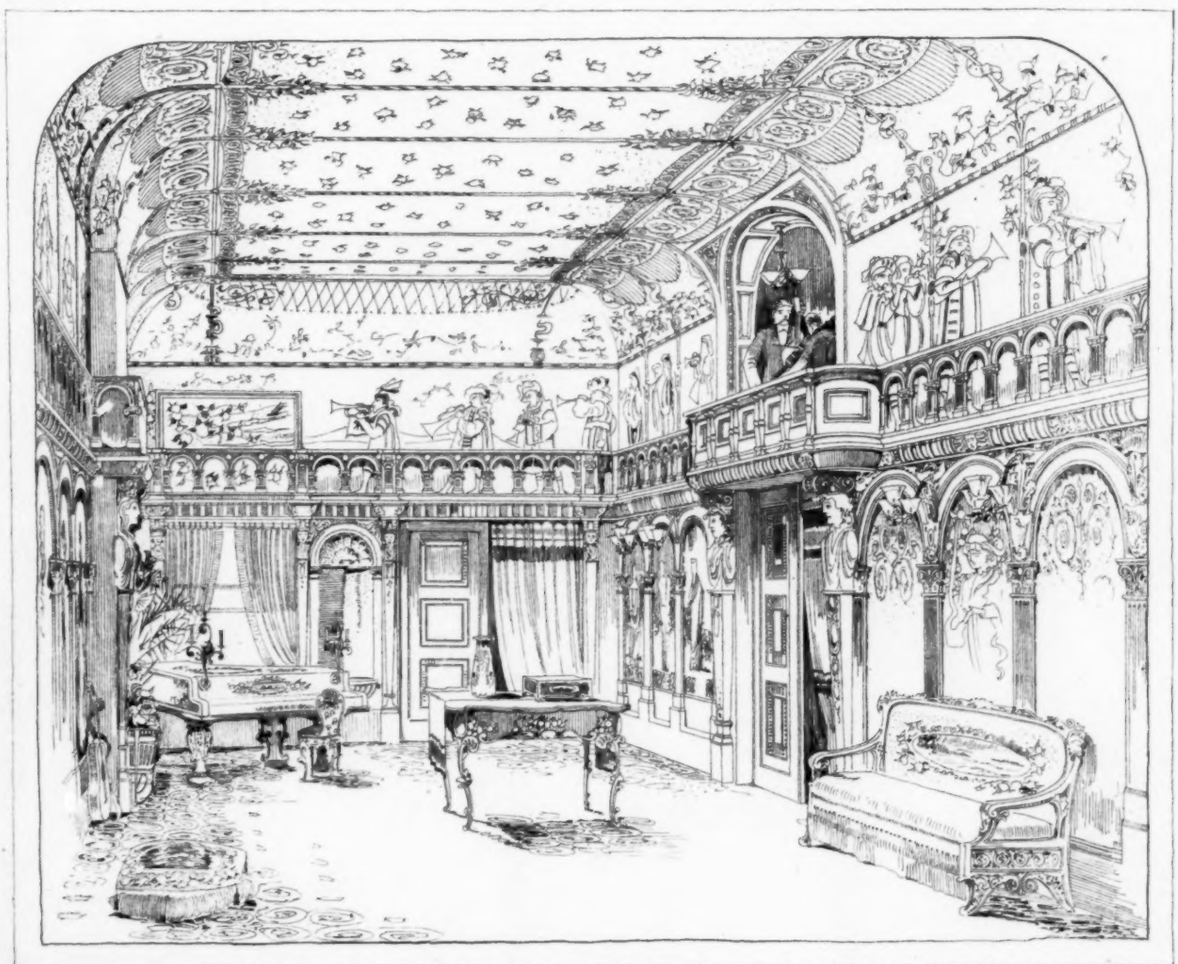

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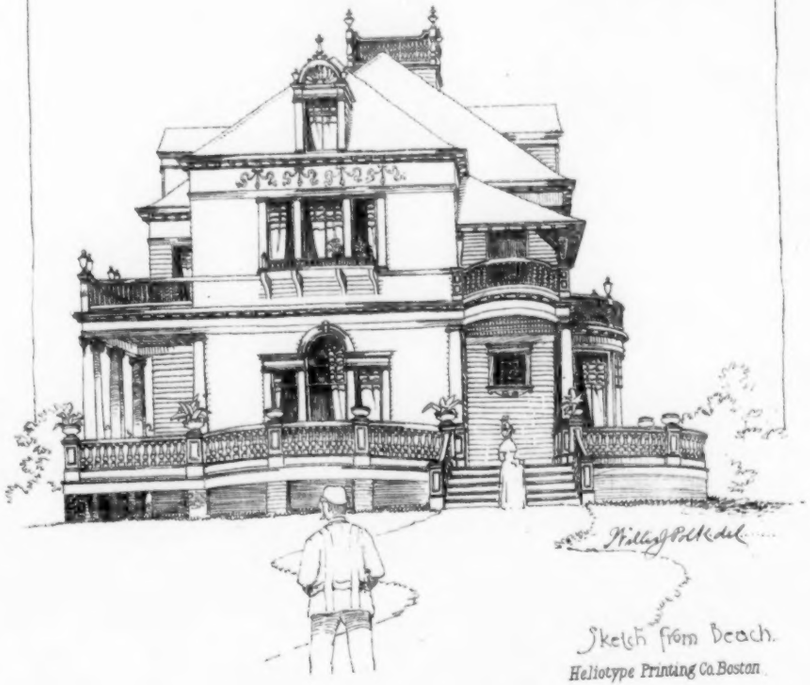
House at Los Angeles.

Ernest A. Coxhead. A.R.I.B.A. Architect

House at Santa Monica.



Sketch from Beach.

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illustrating Paulding in the act of listening, and a bronze bas-relief, representing André offering his watch to his captors. The work of the Association in making more adequate the "inadequate plan of the original monument," consisted in cutting the spire of the old monument into an ugly shape for the placing of the statue, and procuring the bas-relief, all at a cost of fifteen hundred dollars. The origin of the statue is explained in large letters on the face-side of the plinth: "This statue, the gift of John Anderson, a citizen of Tarrytown, was placed here September 23, 1880." Its cost was twenty-five hundred dollars. The statue and bas-relief was contracted for by Mr. Maurice J. Power, of New York. The former bears on its plinth the name of Wm. R. O'Donovan, and the latter, Theo. Bauer. The Association also published a book in 1881, entitled "*Centennial Souvenir of the Monument Association of the Capture of André*," which is quite as remarkable for its omissions as its commissions. It contains one hundred and sixty-seven pages, and sold for two dollars a copy. It pretends to give a full account of what has been done for the memory of the captors, yet it does not give the inscription on, or history of the old monument erected in 1853. Nor does it state that the monument does not stand on the spot where André was captured, as is generally understood. When the monument was erected the land on the north side of the brook, that runs down the hill to the river, including the place of André's capture, was owned by an Englishman who displayed intense hostility to the project. The monument really stands on the south side of the brook, thirty or forty feet from the exact place of the capture.

Of the statue and bas-relief there is little to be said, though in passing, it might be noticed that either Paulding was left-handed, or the powder-horn is on the wrong side of the body.

The statue, in bronze, was not completed in time for the celebration, and the plaster copy, bronzed over, was used, in its stead, for the time being.

The face of the statue was copied from an old portrait of Paulding, and the bas-relief is a reproduction of a current picture, long in existence.

T. H. BARTLETT.

The Major Tallmage, who opposed the Congressional bill appropriating money for the erection of a monument to the captors of André, was a classmate of Nathan Hale at Yale College. He was a fine student and a capable officer in the Revolutionary war, emerging from it with the title of Colonel. By particular direction of Washington he was ordered to report to North Castle on the evening of the very day upon which André was brought to this military post by Paulding, Williams and Van Wart. He was the first, from observing the deportment of the prisoner, from watching the manner in which he walked to and fro on the floor, and turned his heel to retrace his steps, to suspect that he was bred to arms, and was an important British officer.

From this time forward, down to that of the execution of André, Major Tallmage was charged with his custody, and was almost constantly with him. He commanded the escort that conducted him to Lower Salem. It was into his hands that André there placed, for perusal his first letter to General Washington, acknowledging his true character. It was under his charge again, with a strong guard, that André was removed to Robinson's House, and thence to West Point, again to Stony Point, and thence to Tappan, where the court-martial took place. From the Stone-House, where André was confined, Tallmage "walked with him to the place of execution, and parted with him under the gallows," "overwhelmed with grief," he says, "that so gallant an officer and so accomplished a gentleman should come to such an ignominous end." In his narrative of his intercourse with André, he refers to Hale as follows: "Before we reached the Cove, André became very inquisitive to know my opinion as to the result of his capture. In other words, he wished me to give him candidly my opinion, as to the light in which he would be viewed by General Washington and a military tribunal, if one should be ordered. This was the most unpleasant question that had been propounded to me, and I endeavored to evade it, unwilling to give him a true answer. When I could no longer evade his importunity or put off a full reply, I remarked to him as follows: 'I had a much loved classmate in Yale College, by the name of Nathan Hale, who entered the army in the year 1775. Immediately after the battle of Long Island, General Washington wanted information respecting the strength, position, and probable movements of the enemy. Captain Hale tendered his services, went over to Brooklyn and was taken just as he was passing the outposts of the enemy on his return.' Said I with emphasis, 'Do you remember the sequel of this story?' 'Yes,' said André, 'he was hanged as a spy. But you surely do not consider his case and mine alike?' I replied, 'Yes, precisely similar, and similar will be your fate.' He endeavored to answer my remarks, but it was manifest he was more troubled in spirit than I had ever seen him before."

At the close of the war, Tallmage lived in Litchfield, Conn., and was a member of Congress for sixteen successive years. No one friend could speak of another with more enthusiasm and appreciation than Tallmage wrote of André. He cried over the charms of André's conversation. "I am sure he will go to the gallows less fearful of his fate, and with less concern than I shall behold the tragedy. Had he been tried by a court of ladies, he is so genteel, handsome and polite a young gentleman that I am confident they would have acquitted him."

ILLUSTRATIONS

[Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

CANADIAN PACIFIC RAILROAD STATION, MONTREAL, P. Q. MR. BRUCE PRICE, ARCHITECT, NEW YORK, N. Y.

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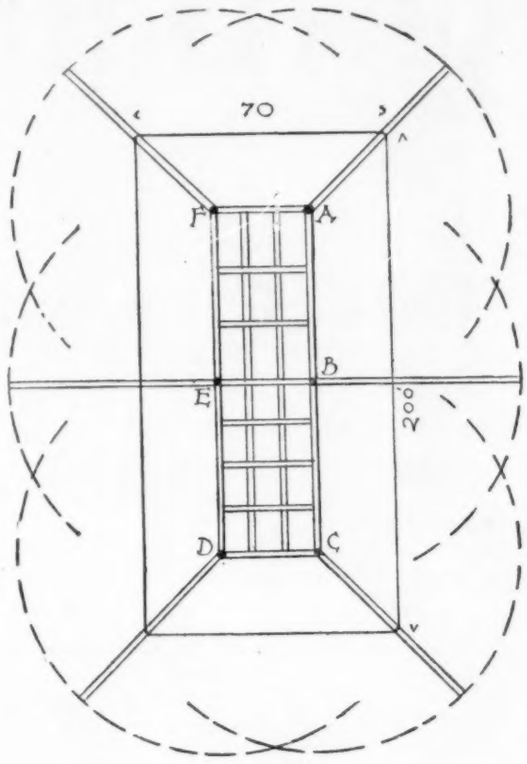
THIS view was made at this stage to show the derrick system devised for setting up the outer walls of the building. The building is 70′ x 200′, a true rectangle, with the four "fronts" of heavy blue limestone masonry, averaging three feet in thickness. The system consists of a heavy trestle, built up in the centre of the building of heavy spruce piling timbers as high as the level of the top-course of stonework.

On top of this trestle six derricks are placed — one at each corner and one at the centre of each lateral side, in the manner shown.

On each longer side of the building are three drums and an engine for working the three derricks of each side. Each boom is long enough to overlap its neighbor, so that with six gangs of setters,



masons and laborers, each gang has practically three derricks to call upon. That is, the arc of B overlaps the arc of A and C, so that whilst B can be helping A with a stone at the north corner, the setters of B derrick can be down towards the south end and getting material from C derrick. This is often the case; for whilst C derrick is loaned to B, C setters will be cutting and fitting a big block just received.

The derricks work very rapidly, and will lift a stone from grade to fourth-floor level in something like forty seconds.

The derrick plant cost about $11,000, and was designed by Mr. P. Alex Paterson, C. E., Chief Engineer of the Canadian Pacific Railroad system, and his assistants on the works, Mr. Stuart Howard, C. E. The whole plant has proved most effective and economical. By it the contractor, raised the building from the water-table level of first floor to level of third-story window-sills, a height of thirty-five feet in twenty-eight working days. In a fireproof building 200′ long by 70′ wide, with heavy walls in and out, this is a first-class showing. The contractors are Wm. Davis & Sons, of Ottawa. They say the plant has, by its great economy of time and labor, already paid for itself.

FIRST PRESBYTERIAN CHURCH, PEORIA, ILL. MR. WALTER H. HAYES, ARCHITECT, MINNEAPOLIS, MINN.

THIS building is to cost $35,000.

FOYER AND MUSIC-ROOM FOR E. LAUTERBACH, ESQ., NEW YORK, N. Y. MESSRS. A. ZUCKER & CO., ARCHITECTS, NEW YORK, N. Y.

BUILDING FOR DANIEL A. LORING, ESQ., NEW YORK, N. Y. MESSRS. LAMB & RICH, ARCHITECTS, NEW YORK, N. Y.

THIS fireproof building is to be used for bachelors' apartments, offices and studios. It will be finished in about a year.

HOUSES AT LOS ANGELES AND SANTA MONICA, CAL. MR. ERNEST A. COXHEAD, ARCHITECT, LOS ANGELES, CAL.

SPIRE OF ST. PAUL'S, NEW YORK, N. Y. DRAWN BY MR. C. H. ISRAELS.

TAPPING A VOLCANO FOR SULPHUR. — A scheme is under consideration in Mexico for tunneling the volcano of Popocatapetl through the wall of the crater, in order to reach the immense sulphur deposits inside the mountain. A narrow-gauge railway will connect the tunnel with the town of Amecameca, which, in turn, will connect with the Morelos road leading to the national capital. — *English Mechanic.*

DRY-ROT IN TIMBER.[1]

Warnings.

Column at Ravenna.

No wood which is liable to damp, or has at any time absorbed moisture, and is in contact with stagnant air, so that the moisture cannot evaporate, can be considered safe from the attacks of dry-rot (1, 3, 4, 5, 7, 9, 10, 17).[2]

Any impervious substance applied to wood which is not thoroughly dry tends to engender decay: Floor covered with kamptulicon and laid over brick arching before latter was dry (16); cement dado to wood partition (1), the water expelled from dado in setting and absorbed by the wood had no means of evaporation.

Woodwork coated with paint or tar before thoroughly dry and well seasoned is liable to decay, as the moisture is imprisoned.

Skirtings and wall panelling very subject to dry rot (4, 9, 17), and especially window-backs (4, 17), for the space between the woodwork and the wall is occupied by stagnant air; the former absorbs moisture from the wall (especially if it has been fixed before the wall was dry after building), and the paint or varnish prevents the moisture from evaporating into the room. Skirtings, etc., thus form excellent channels for the spread of the fungus (9).

Plaster seems to be sufficiently porous to allow the evaporation of water through it (1), hence, probably, the space between ceiling and floor is not so frequently attacked, if also the floor boards do not fit very accurately and no oil-cloth covers the floor.

Ploughed-and-tongued floors are disadvantageous in certain circumstances, as when placed over a space occupied by damp air, as they allow no air to pass between the boards and so dry them (3, 4).

Beams may appear sound externally and be rotten within (8, 14), for the outside being in contact with the air becomes drier than the interior. It is well, therefore, to saw and reverse all large scantling (14).

The ends of all timber, and especially of large beams, should be left free (for it is through the ends that the moisture chiefly evaporates). They should on no account be embedded in mortar (8).

Inferior and ill-seasoned timber is evidently to be avoided (7, 17).

Whatever ensures dampness and lack of evaporation is conducive to dry-rot, that is to say: —

Dampness arising from soil (3, 4, 7).

Dampness arising from walls, especially if the damp-proof course has been omitted (15).

Dampness arising from use of salt sand (15).

Dampness arising from drying of mortar and cement (1, 8, 16).

Stagnation of air resulting from air grids getting blocked with dirt (4), or being purposely blocked through ignorance. Stagnation may exist under a floor although there are girds in the opposite walls, for it is difficult to induce the air to move in a horizontal direction without some special means of suction (2, 6). Corners of stagnant air are to be guarded against (7, 12).

Darkness assists the development of fungus; whatever increases the temperature of the wood and stagnant air (within limits) also assists (1, 2, 5).

Hot-water pipes are especially prejudicial, for they heat the woodwork, etc., by conduction, and are liable to leak (3).

The leaving of chips, shavings, etc., under boarded floors is a most reprehensible practice, for the chips are very liable to attack, lying, as they often do, on the damp ground (3, 12).

Suggestions.

All ground under boarded floors should be covered by an impervious substance — concrete, blue lias lime (3), asphalt (4), Portland cement (2).

For churches, solid wood-block flooring is preferable to joists and boards (3).

To ensure the thorough dryness of a boarded floor the boards may be laid three-eighths of an inch apart (3), or small gratings may be inserted at intervals (1).

Notes on the Foregoing.

Eremacausis.— In several of the above cases there has been complete decay yet no signs of fungus. This may have resulted from eremacausis, which may be considered as "wet-rot." The eremacausis of woody fibre is due to the gradual oxidation of its lignin and other chemical constituents in presence of atmospheric oxygen and water, the O ultimately taking the C to form CO_2 and the H to form H_2O. The H, however, becomes more rapidly oxidized than the C, and the formation of a brown snuff-colored powder or *humus* (similar to that produced by dry-rot fungus) results, which is much richer in C than the woody fibre. Moisture is a necessary condition of the process, and the most suitable temperature is about 60° F.

Disruption of concrete by fungus.— In 2 a case is referred to in which the mycelium of the fungus had disrupted a layer of concrete. I think a more likely explanation is as follows: — The foundations have settled, the concrete under the boarded floor has become cracked, and the fungus attacking the timber has spread in the direction of greatest moisture, and so over the concrete and down the crack to the damp soil beneath.

Fungus passing through walls and growing in the soil.— The mycelium of the fungus has the power of passing its nitrogenous and nutrient substances from the older to the younger growing parts. It thus has the power of growing in, and on the surface of the substances which afford it no nourishment. It may in consequence creep over brickwork, plaster, and even glass and iron, and thus reach woodwork at some distance. This growth is greatly assisted if the surfaces over which it spreads are themselves damp. In this way it may pass through the interstices of plasterwork and brick walls, and ramify in the soil. It is also able to convey its moisture from a distance, so that it is necessary that everything in the neighborhood of woodwork should be dry, and that the soil under boarded floors should be covered by an impervious layer.

Fungus growing in air-grating. — In 6 and 12 the fungus is said to have been growing "in the ventilating opening," and "in a draught." With regard to the first, it may be remarked that ventilation is not at all a necessary consequence of the insertion of an air grid, inasmuch as there must be a want of equilibrium resulting from difference of density in the air on the inside and outside of an inclosed space. The fungus may therefore have found the air in the ventilating opening as moist and stagnant as elsewhere; and the case shows that it is necessary to introduce some method of suction to ventilate under floors.

Fungus growing in a draught.— Secondly, it is not the mere movement of the air, but the evaporation which usually results, that is detrimental to the fungus; if, therefore, the locality is a very damp one, and the incoming air is as damp as the outgoing, the fungus may quite possibly flourish "in a draught." Moreover, it must be remembered that the fungus is able to transport moisture, and also condense it from the air.

Stagnant air between joists. — Case 2 seems to indicate that there was ventilation under the church floor, and yet the air was sufficiently stagnant to allow the under surfaces of the boards to remain damp. I think the current of fresh air should be made to move in the direction of the joists, and not across them, for it is quite possible that in the latter case the air between the joists may stagnate.

Decay at contact of different timber.— In case 8 is an instance of peculiarity sometimes observed that, when pieces of two different kinds of wood are placed in contact; the harder is more liable to decay.

Durability of larch.— It is to be noticed in case 11 that the joists of *larch* remained sound. Larch is better able to withstand the effects of moisture than fir and pine.

Germs in walls and from dead bodies,— In case 2 it was concluded that germs of the fungus were in the walls or had arisen from bodies buried in the ground. Spores carried hither and thither by a variety of means may have settled *on* the walls, but it is not probable that the dead bodies could have had any association with their presence. Bacteria they very likely would produce, but the "dry-rot" spore is far more highly organized.

Spontaneous generation.— In one instance the origin of the germs is attributed to spontaneous generation. This, of course, is a theory now discarded.

Wood bedded in mortar.— Wood bedded in mortar is liable to decay, for the water of the mortar is absorbed by the wood; and, in the process of setting, the mortar may decompose some of the organic substances of the fibre, especially if the lime has not been thoroughly slaked, as it then tends to absorb the elements of water from the substances near it.

Removal of infected timber.— It is safest to remove all infected timber, and burn it. Merely scraping away the fungus, and then coating the timber with an impervious substance will frequently assist the growth of internal disease, as it imprisons the moisture.

Seasoned and unseasoned wood.— Under favorable conditions of temperature and dryness, ill-seasoned wood may stand as well as seasoned; but it is far more liable to decay in a warm damp atmosphere, as it contains more fermentable substances, and affords nourisment for a far more luxuriant growth of fungus. When, however, the wood is to be creosoted, the sap-wood is better than the heart-wood, as it is more porous and absorbs the oil better.

Species of fungi.— It is dangerous to identify a fungus by such very meagre descriptions as are given in the MSS., especially when no reference is made to the form of its fructification. Still I think it probable that whereas in the majority of cases *merulius lacrymans* is the destructive agent, in cases 7 and 14 it may have been *polyporus vaporarius*. The effects on the wood are the same in the case of *merulius* and *polyporus*, except that with the latter the decayed wood becomes marked with streaks and patches of reddish brown,

[1] A Report presented to the Science Standing Committee by W. H. Bidlake, M. A. Cantab. *Associate.*

[2] These numbers and others which follow refer to the cases particularized later.

and it is known in timber yards as "red rot." The mycelium of the fungus is also whiter. Unlike merulius, this fungus is found wild in the forests, and the timber is often attacked by it as it lies felled on the ground. Professor Hartig states that the spores often become lodged deep in the cracks, and are there imprisoned by the swelling of timber as it floated down to the ports. In the close ship's hold, or afterwards in the stack yards, the spores germinate, and the timber on being sawn is found to contain furrows of red powder. — W. H. BIDLAKE, M. A. Cantab.

DIGEST OF VARIOUS NOTES AND MSS. REFERRING TO "DRY-ROT" IN TIMBER.

(1) *Architect.* — Boult, J., Esq. *Locality.* — Liverpool and London Chambers. *Position.* — Partitions to height of 4 feet and flooring beneath. *Circumstances.* — Wood partitions dividing office finished with cement dado, 4 feet high. All timber above dado sound. *Ventilation.* — Floors fireproof, hence lower part of partitions formed air-tight cells. *Heating, etc.* — Rooms kept warm. *Treatment.* — New partitions with 2 small pieces of perforated zinc inserted between each pair of quarters, near floor on one side and ceiling on the other. *Result.* — Quite satisfactory. *Notes.* — Water expelled from dado in setting had no means of escape. No fungus. Decay due probably to eremacausis.

(2) *Architect.* — Ferrey, B. E., Esq., F. S. A. *Locality.* — Old Church in Worcestershire. *Foundations.* — 12 inches clear space below joists. *Timber.* — Appeared well seasoned. *Position.* — Floor. *Circumstances.* — Rot appeared five years after restoration and reseating. Slight moisture on underside of boards. Oak joists fairly dry. *Ventilation.* — "Perfect." Air gratings in walls, and 4-inch earthenware pipes under passages. *Heating, etc.* — Hot air with gratings in passages.

(3) *Architect.* — Ferrey, B. E., Esq., F. S. A. *Locality.* — Old Church in Somersetshire. *Position.* — Floor and block of ceiling. *Circumstances.* — Possible leakage from hot-water pipes. Shavings left under floor; on them the fungus was especially luxuriant. Floor tongued and grooved. *Ventilation.* — *None.* Stone ventilators inserted, but only perforated half through thickness of wall. *Heating, etc.* — Hot water pipes. *Treatment.* — Shavings removed, pipes repaired, ground covered with layer of blue lias lime, timbers soaked with a solution of ½-pound zinc sulphate and ½-pound copper sulphate to 4 gallons of boiling water. *Notes.* — In some parts there was a little, though insufficient ventilation; here the fungus was not much developed.

(4) *Architect.* — Holden, J., Esq. *Locality.* — Warehouses, New Brown St., Manchester. *Foundation.* — 2 feet to 2 feet 6 inches space under boards. *Position.* — Basement floor, sills, shutters, etc., and stairs. *Circumstances.* — Floor 3 inches tongued and grooved. Sills and shutters attacked to 3 feet 6 inches high, and where stairs were connected with floor; fungus passing upwards in the strings. *Ventilation.* — Space under floor ventilated by vertical air shafts from bottom of window areas. These were blocked with dirt. *Treatment.* — Ground covered with asphalt; walls washed with solution of sulphuric acid; ventilating openings altered so as to prevent their being stopped; communication with flues where possible. *Result.* — Successful. *Notes.* — Under boards a mass of fungus, beautifully white in parts; timber sound near fireplace, where there was slight ventilation. Timber in adjoining warehouse sound, although there was no means of ventilation, but the ground had, in this case, been covered with asphalte.

(5) *Architect.* — Holden, J., Esq. *Locality.* — House, Park Place. *Timber.* — Red deal. *Position.* — Beam carrying wall over opening in basement. *Circumstances.* — Ill-ventilated corner. Kitchen department in vicinity. *Ventitation.* — Sufficient. *Heating.* — Kitchen warmth. *Treatment.* — Fungus removed, beam soaked with gas tar. *Result.* — Unsuccessful. *Notes.* — Hence iron girder substituted.

(6) *Architect.* — Holden, J. Esq. *Locality.* — Mill, Salford. *Position.* — Under ground floor. *Ventilation.* — Air openings on each side of building, and through sleeper walls. *Notes.* — Strongest growth of fungus close to ventilating opening. The ground beneath was full of threads of fungus continuous with that above.

(7.) *Architect.* — Mathews, J. D., Esq. *Locality.* — House. *Position.* — Landing of cellar steps. *Circumstances.* — House "jerry-built," finished and untenanted a year. In back cellar, under stone steps, ground of loose soil left, not having been flagged; wood landing over attacked by fungus, which spread along wall to cellar. *Ventilation.* — Corner of stagnant air. Cellars only ventilated occasionally by window. *Notes.* — Wood assumed brownish-red color thickly covered with sickly-whitish fungus. very luxuriant, often of stalactite form. Sickly smell.

(8) *Architect.* — Paull, H. J., Esq. *Locality.* — Sir F. Crossley's Orphan Home, Shirkcote Moor, Halifax. *Timber.* — Crown memel timber and oak. *Position.* — Floors, beams, etc. *Circumstances.* — Structure built up to first and second floors then left four years unprotected from weather. Floor beams, 18 inches by 14 inches, sawn and reversed, each trussed with piece of oak, 4 inches by 3 inches, ends on stone templets, built closely in wall with *mortar*. These, without exception, rotten, decay spreading through centre of each beam, sometimes four or five feet, sometimes the whole length. Oak in all cases more decayed than deal. Fungus extended through walls, so that much brickwork had to be taken down. It thus spread from one part to another. *Treatment.* — All affected parts taken down and removed. *Notes.* — Beams showed little indication of decay externally, but the centre of each was rotten. The fungus appeared on the surface like a fine cobweb; the ramifications branching out in all directions of cream-white and dark-brown color.

(9) *Architect.* — Paull, H. J., Esq. *Position.* — Under-ground floor. *Circumstances.* — Fungus crept up from under floor behind. skirting, thence under tile floor of hall to skirtings on opposite side, then through wall into garden where it ramified in the soil. *Ventilation.* — Space under floor unventilated.

(10) *Architect.* — Bridgen, R. B., Esq. *Locality.* — Children's Hospital, Pendlebury. *Position.* — Wood casing of electric bell wire. *Circumstances.* — Casing bedded in concrete; floor of corridor close to skirting, to which the rot rapidly spread. *Treatment.* — Cement skirting substituted; walls twice washed with solution of corrosive sublimate.

(11) *Architect.* — Redmayne, G. T., Esq. *Locality.* — House, Lake District. *Foundations.* — Dry stony ground overlying rock; rubble foundations; excavated 2 feet to 4 feet under floor. *Timber.* Red deal boards, larch joists. *Position.* — Floor, skirting, etc. *Ventilation.* — Fair current of air. *Treatment.* — Rotten wood replaced by new. *Notes.* — Window backs and skirting with blistered appearance; wood quite rotten behind a skin of paint; floor looked sound, but quite rotten within ⅛ inch of surface, and looked as if charred beneath; joists of larch sound; no signs of fungus.

(12) *Architect.* — Redmayne, G. T., Esq. *Locality.* — St. John's Church, Brooklands. *Foundations.* — Deep sandy soil; 5 feet to 8 feet space under floor. *Position.* — Door frame of space below organ chamber. *Circumstances.* — Space under organ chamber occupied by hydraulic blowing apparatus; fungus traced along floor to a log of wood, part of centring of vaulting, which had been left. *Ventitilation.* — Space under nave well ventilated by large grids, but under organ was a stagnant corner. *Treatment.* — Walls washed with solution of corrosive sublimate, timber washed with carbolic acid, parts scorched with naphtha lamp. *Result.* — Successful.

(13) *Architect.* — Redmayne, G. T., Esq. *Locality.* — Schools at Tintwistle. *Foundations.* — Hillside; excavated out of rock; drained dry. *Ventilation.* — Ample ventilation. *Treatment.* — as in No. 12. *Result.* — Successful. *Notes.* — Stringy white fungus appeared in the neighborhood of a draught.

(14) *Architect.* — Redmayne, G. T., Esq. *Locality.* — House, Lancaster. *Timber.* — Pitch pine. *Position.* — Log. *Notes.* — Log externally sound, but the centre was filled with long strings of fungus, tough and like wet white kid; timber wet and seemed full of resin; broke short like carrot.

(15) *Architect.* — Redmayne, G. T., Esq. *Locality.* — House, Northwich. *Foundation.* — Quick sand. *Position.* — Floor joists; window backs of ground floor. *Circumstances.* — Cellar, walls, and floors (flags laid on sand) wet, no damp-proof course; joists carried on plates, propped up from cellar floor with posts set on stone blocks; posts also rotten, as well as feet of rafters; furniture worm-eaten. *Treatment.* — Rotten timber removed; boards and walls washed with carbolic acid; dry trench round house; vaulted cover with air grids; cellar and trench with concrete bottoms at level of footings with outward fall; cellar paving laid on sleeper walls, and cellar walls cemented outside. *Notes.* — Walls covered in places with black fungus growth, in beautiful delicate, seaweed-like sprays. Dampness of house probably in part due to the use of salt sand.

(16) *Architect* — Waterhouse, A., Esq., R. A. *Locality.* — House. *Position.* — Ground floor. *Circumstances.* — Floor laid over brick arching before latter was dry. *Ventilation.* — Floor covered with kamptulicon.

(17) *Architect.* — Waterhouse, A., Esq., R. A. *Locality.* — House. *Foundation.* — Sandy. *Timber.* — Inferior timber. *Position.* — Panelling. *Circumstances.* — Especially under window-sills; spread rapidly to floors and skirtings through house. *Treatment.* — Parts affected cut out; rest washed with solution ½-pound copper sulphate to 1 gallon of water. *Result.* — Successful.

STEEL IN FOUNDATIONS. — The use of steel rails for the foundations of large buildings has long been followed in the spongy soil of Chicago. Some of the more recent large structures have combined the use of steel beams with rails, notably the Edison Electric Light Company's building and the great auditorium in which the National Republican Convention has just been held. The Tacoma building, now being erected on the corner of Madison and La Salle Streets, under the direction of Holabird & Roche, architects, is the first to use steel beams exclusively for foundations. This building will be 12 stories and an attic in height, and is intended for offices. Its walls will therefore be very massive and the partitions will be supported on large pillars built up from the ground. The foundations for the walls and pillars consist, first, of a bed of concrete 2 feet thick, second, of steel I-beams of different dimensions, according to circumstances, crossed wherever necessary, and third, of cast-iron plates in the case of the columns. The beams stand on edge, are placed closed together and are long enough to extend from 6 to 7 feet outside of the columns. They are enveloped in concrete after being placed in position, to guard against oxidation and also to secure further rigidity. Over 120 tons of steel beams will be required for the foundations alone of this building. They were adopted in preference to steel rails, because their aggregate cost is about one-third less, as several tiers of steel rails would have to be used to secure the stiffness of the beams, thus more than covering the difference in the cost per ton. — *Iron Age.*

BOOKS AND PAPERS

IN consenting to write the biography of Henry Hobson Richardson,[1] Mrs. Van Rensselaer entered on a task which was not easy to accomplish to every one's satisfaction. A memorial prepared at the instigation of friends presupposes that the work must be approached from that point of view which is likely to give the pleasantest impression of the subject of the biography, his good points must be brought out with strenuousness, his indifferent ones merely hinted at, and his bad ones, if he had any, passed over in silence. His personal character must, in short, be presented in its pleasantest light, and darker moods and selfish acts must go without comment. In the same way, though in a less degree, the friendly biographer feels impelled to dilate in warmest phrases on the successes and slur over the failures in his career.

In the next place, the present work is not only a biography of the man, but it is intended to be a critical consideration of his works and their architectural value, both at the present time and in the future. Here it may be well to say that we are far from sharing a quite common feeling that it is not possible to value properly an artist's work in his own day and time — particularly the works of an architect. If the appreciation of architecture rests upon real canons of criticism, if there are any absolute laws to which we may appeal in our endeavor to decide between good work and bad, we are surely as able to apply them to buildings finished yesterday as to works which have received the applause of centuries. It is often necessary to wait years or even centuries before a correct history of events can be written, simply because it is not possible to sooner get at all the facts. A building, however, is a single fact that can be examined from every point of view and can be gauged at any time according to the same standards of absolute worth that the world applies to older work. It is, then, a book with a compound motive, it is addressed to a double audience, to the layman who knew Richardson or who was interested in his work, and to the architect who is only interested from a professional point of view in what he accomplished and his reasons for doing what he did.

Mrs. Van Rensselaer is too conscientious a person and too good a critic not to be conscious of the pitfalls that surround such a devious path, but, also too skilled a writer not to be able to give her readers the impression that after all she has said pretty much what she really wanted to say. In one respect, at least, the task has been unusually easy. In dealing with the works of artists, the biographer usually feels called on to attempt the analysis of the motives which governed him in producing a given work and to reproduce, with the most wonderful subtilty of imagination, the course of reasoning which led to the result. Richardson had very emphatic motives for what he did, to which he was brought by very logical trains of reasoning, and it would not always be easy for a biographer to reproduce them; but fortunately for us there was one thing that Richardson liked to do more than anything else — to talk about himself and his work, rarely about himself alone, but always about his work, and he was so integral a part of his work that he could not, when talking about it, avoid talking about himself too, and at the end of a chat it was difficult for the listener (he could hardly be called a collocutor) to determine whether he had learned more about the work or the man who was doing it. The laughing apology that Richardson always made when he found he was working into one of his enthusiastic monologues was felt by the listener to be a quite unnecessary apology for any seeming egotism, and if the idea had not been suggested by the speaker, the undeniable fact that the discourse was somewhat one-sided would have been lost to sight in the pleasure of listening to the outbursts of real enthusiasm and in the vague wonderings why nature had not endowed other people with the same all-powerful supporter. It was, then, unusually easy for one who had understandingly listened to many of these exegeses to lay before her readers the logical development of the work that Richardson accomplished and to point with some certainty to the goal toward which his work in the future would have tended.

Considering the great individuality of the man, his personal magnetism, his lack of conventionalism, and the tremendous energy he put into his work, we are rather disappointed that more was not made of the strictly biographical part of the book. Those who knew him can fill in around the outlines of the sketch, which gives the essential facts of his personal career, but those who never found themselves refreshed by encountering, even briefly, this living hurricane will gather dissimilar impressions of a man who was impulsive and yet not inconsiderate, impetuous enough at times to overcome every obstacle, even if others were shouldered aside in the onrush, and yet kindly and loving to the farthest degree, unyielding when the point at issue must be gained for the good of his work — not his own good — preoccupied with his own work so that he was accused of being inconsiderate of the support he ought to give his fellow-architects, and yet ready to enter heart and soul into the enthusiasm of some pupil who was just beginning life for himself. But, as he felt that his work was himself, perhaps his biographer became imbued with the same belief and thought that, in considering the works, the reader would in every necessary degree divine what manner of man it was that wrought them.

In one thing we feel distinctly defrauded. A biographer tells the story in the language which custom has hallowed. If there is a *cachet* to the work, it is that of the writer, the dish is mixed according to his taste and the seasoning is the flavor of his literary style: the subject of the biography has no hand in it, and the individuality that stamped his life may never be perceived by the reader if he is not allowed to speak for himself in his own words. There is only one way in which one who has gone before can thus posthumously declare himself truly — by his letters, letters not written for publication, not treatises nor lectures, but the frank unfoldings of his inner self to those who really understand him. So good a conversationalist as Richardson must have had it in him to be a good letter-writer, and the almost entire absence of letters from this biography cannot but be regarded as a very regrettable, though apparently irremediable defect, — since probably the greater part of his correspondence during his life at Paris, when the agitating changes in the fortune of his family, were taking place, was addressed to one who naturally does not care to have these letters laid before the public, the few extracts that are given do not seem notable or individual, but rather dry and commonplace.

In the second part of her task, the difficulties were not so great; the accomplished results were accessible and in most cases the biographer knew from the creator himself why and how they had been accomplished and in what esteem he held them. Taking the work in almost chronological sequence, we are shown how step by step the architect worked into the conviction that there was for him only one style of architecture, and, if he was to do his best, only one class of buildings that he really cared to undertake. The real possibilities of the style he devoted himself to were not fully perceived by him until his trip to the south of Europe three or four years before his death, and it is probable that it was a grievous disappointment to him that the chance to mark his own advance was denied him by the awarding of the Albany Cathedral competition to another. Here there seemed to be a chance to put in play the inspirations acquired during his recent trip through Southern France and Spain, and to show how far beyond the work at Trinity Church the studies and opportunities of a mere decade had qualified him to go. The design for this building is familiar to our readers and is both imposing and attractive, though who can say to what farther point it might have been carried in the final studies and during construction? The causes that led to the miscarriage of this enterprise are typical of the man and the man's artistic conscience. The terms of the competition fixed a certain limit of cost and demanded a design in the Gothic style. Richardson disregarded both, the first because the sum named was too small to do what he wanted to have done, and the second because he did not like Gothic and felt that it was not as well suited to our day and country as that other style he loved to work in. To offset both these imprudences, he relied on the abstract merits of his solution of the problem and his powers of persuasion. It was, of course, an immoral thing to do and the rebuff was deserved, but one cannot help regretting that the attempt was not successful.

The Court-house at Pittsburgh, however, gave him, very shortly after, the opportunity that he failed to get at Albany, and it was an opportunity rather more in his peculiar line than the other would have been; and as he soon became thoroughly absorbed in it and often expressed the desire that he should be valued according to the success of this building rather than by any other work that had preceded it, it is not easy to see how, at the same time, he could have carried on two such buildings and have done credit to both chances. As his personal feeling about this building was so strong, it seems rather strange that a greater number of illustrations of it were not included amongst the many which so adequately illustrate this work. The great arched-passageway, spanning the street between the jail and the Court-house, is, no doubt, a feature in the whole scheme, but the gelatine print of it could have been replaced with great gain by one that would have told us something about the architecture of the main building. A great many more of the charming little sketches of the details of this building might have been added, too, and only increased our obligations to those who have, by their skill with the pen, done such satisfactory work in the way of illustrating points which it was not advisable to dilate on at length.

The scheme of such a work requires that the illustrations should have, at least, equal interest with the text, and both in quality and quantity this requirement has been heeded, and though the illustrations number only about one hundred, and though they might have been quintupled without beginning to exhaust the supply of acceptable subjects, they give the work the air of being most sumptuously illustrated; and though many of the subjects selected have already been made familiar to the readers of this journal, they are here often presented from new points of view, and their coördination and combination give them a value that is wanting to the same things scattered through the files of a periodical. We have done nothing toward showing our readers what Richardson did in the line of house-architecture, largely because we felt that in designing houses he was undertaking work to the acceptable execution of which his chosen vein of design did not successfully accommodate itself, and we find on comparing the houses here shown with his other works, that this opinion is only strengthened. There is a ponderous and

[1] "*Henry Hobson Richardson and his Works*," by Mrs. Schuyler Van Rensselaer, with a portrait and illustrations of the architect's designs. Boston and New York: Houghton, Mifflin & Co. 1888. Five hundred numbered copies, only, printed. Price, $20.00.

repellant air about some of them which must make people feel that though it may be worth while that they should exist, it is particularly fortunate that more clients were not found who were willing to seclude themselves behind dungeon walls. In the house for Mr. Glessner at Chicago, however, a new vein seems to have been hit upon, and one which seems more likely to have really interested the designer than the houses for Mr. McVeagh or Colonel Hay, and though it is shown only by a very slight sketch, the plan is a very interesting one, although like many of Richardson's plans it can hardly be considered a thoroughly good one. Indeed, we are disposed to disagree with Mrs. Van Rensselaer and with Richardson himself, as to the merits of some of the plans which both regarded as particularly good, for instance, Austin-Hall, at Cambridge, is found by those who use it anything but convenient, while at North Easton the arrangement and size of the main stairway shows a reckless disregard of the canons of good planning. It would not surprise us to hear that the inadequacy and faulty arrangement of these stairs had been the cause of a serious disaster to a panic-stricken audience.

One of Mr. Richardson's minor aspirations was that he might be called upon to design a grain-elevator, as he felt that here was one of the brutal utilitarian problems which was wrongfully neglected, and that it only needed an example to set a limit to the erection of the ordinary unsightly masses that disfigure the lake shores of our Western cities. He seems to have had a chance to set an example as to how to treat one other class of structures which is usually neglected as being too hopelessly commonplace for any one to consider it and architecture in the same connection, for we find one of the chapters headed by a little vignette, which shows how he would treat an ice-house: it reveals how by a judicious management of the inclined plane and roofs a building may be built which will add to the beauty of the shores of our ponds, not be hurtful to it.

The vignette that heads the preceding chapter recalls a rather curious incident. The owners of the Fall River line of steamboats, the Old Colony Railroad, had long felt the need of an extra light-house at the entrance of Narragansett Bay, but, we believe, the Light-house Board did not feel that the case was as urgent as some others, and declined to authorize the erection of the desired beacon. Finally, the railroad offered to pay for the erection of the tower if Government would equip and maintain it. This proposition was accepted, and a search was made for the proper site. It was finally decided that the place for it was on a point forming part of the estate of Professor Agassiz who spends his summers at Newport, and who, not unnaturally, objected to the erection there of one of the usual whitewashed cylinders. But perceiving the real desirability of having a light there, he at length waived his objections, provided that the structure should be designed by a person selected by him. This being agreed to, Richardson was asked to make sketches, and, finally, the necessary drawings, which were then delivered to the Light-house Board for execution. Everything seemed to be satisfactorily and harmoniously arranged, and the steamboat pilots rejoiced in the belief that in another year their care might be slacked off one point, when it was discovered at Washington that the building could not be built as designed. However, as it was we believe nothing so serious that the substitution of iron for stone would not remedy, it is probable that the pretty little tower will be erected so as to appear outwardly as it was designed.

Perhaps the most interesting chapter in the book is that devoted to Richardson's methods of teaching, and it comes as near as mere words can come to explaining how it was possible for the work that emanated from his office to be so unquestionably the design of one and the same man, and yet that man one whose fingers rarely handled pencil and paper in the way that designers ordinarily use them. A less magnetic man would have found it impossible to bring his many pupils *en rapport* with him, and the buildings produced in such a man's work-room would have been but the dissimilar creations of designers of greater or less individuality, and could not have borne the impress of one man's artistic impulse. A man less well read, less thoroughly trained could not have successfully followed his course of evolving a design quite as often by a process of negation as in any other way, and no man of less capacity for gauging the real ability of his assistants could have secured and retained the help of the pupils who actually worked out his designs, but who worked them out in such a way that there was never any question as to whose mind it was that was controlling the development of the conception. It is a very common thing to hear an able draughtsman say that such or such a building which is credited to his employer was actually designed and worked out by himself, but though we know many of the men who have held leading positions in Richardson's office we never heard any of them advance such a claim in his own behalf. The relation between Richardson and his assistants was singularly loyal on both sides, and Mrs. Van Rensselaer does well and gracefully to dedicate to them this book which both in matter and manner fittingly marks an important period in the advance of architecture in America — and what one man did to make it noteworthy.

ONE of the late volumes in the "*Bibliothique d'Histoire et d'Art*" (published by Henri Laurens, Paris) is M. Paul Marmottan's "*Les Statues de Paris.*" It describes in an interesting manner some thirty-four statues, giving their history and in a few instances that of their predecessors (for several of them succeed monuments which were destroyed in the Revolution) not forgetting some timely information about the persons represented. M. Goutzwiller has illustrated the book with drawings which are, on the whole, very satisfactory.

The author has, we know not why, omitted several monuments. We do not find those of Louis Blanc and François Villon in the Place Monge, of Dante at the Collège de France, of Papin and Leblanc in the court of the Conservatoire des Arts et Métiers. The oldest statue described seems to be that of Henri IV on the Pont Neuf which dates back to 1818. This is not very old compared with those in other cities of Europe (even London has two or three which have seen a couple of centuries) but then one must not forget the revolutions. It would also seem that Paris, though a centre of the arts, has not so many statues as London, who outnumber hers by one-half. Of course we are speaking only of detached portrait statues, not reckoning those forming part of the architectural scheme of such buildings as the Louvre or the many ideal ones to be found in the Tuileries and Luxembourg gardens and elsewhere. Lutetia's "counterfeit presentments" can be seen, however, while many of the statues of the "modern Babylon" are practically invisible because of soot and grime, and in artistic merit the Parisian memorials would doubtless bear away the palm, though some of them are poor enough. It is curious to find that New York has almost as many statues as are catalogued in M. Marmottan's book.

COMMUNICATIONS

RUSTLESS-IRON HARDWARE.

STAMFORD, CONN., June 28, 1888.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — We note with much interest the editorial remarks in your issue of the 23d inst., on the subject of new material for builders' hardware, from which it is evident that your attention has not been called to a product which has lately been put on the market.

This, although not literally a new material, is practically such, by reason of the new effects and new qualities which have been produced. We refer to the employment of iron, both cast and wrought, the surface of which, after decoration and finish in any desired manner, is converted into a permanent and rustless oxide by treatment in the Bower-Barff furnace. You are doubtless familiar with the discovery by Messrs. Bower & Barff of the process which bears their name, whereby articles of wrought and cast iron are exposed at high temperature to the action of certain gases, the effect of which is to change the chemical composition of the metal on its surface, and to a considerable depth, converting it into the black or magnetic oxide of iron. This is a deep, lustrous black, beautiful both in tone and texture, and having the remarkable quality of being entirely unaffected by exposure either to the atmosphere or to handling. It requires no protection by lacquer or varnish of any kind, and is permanent and unchangeable.

Under license from the owners of the American patents covering the Bower-Barff process, we are now producing a great variety of ironwork, both wrought and cast, adapted to this treatment. It has been furnished for many large buildings, such for example as the "Rookery" Building, of Chicago, as well as for private houses of the most expensive kind. The effect of metal-work thus treated is especially pleasing in combination with natural wood of almost any variety. Its beauty cannot be reproduced by any process of illustration, nor fully appreciated without actually seeing samples of the work. We send you herewith one or two small specimens, an examination of which will, we think, convince you that this new product goes far towards meeting the requirements set forth in your editorial above referred to, especially when combined, as it may be, with other metals in cases where more display or elaboration is thought desirable. Yours respectfully,

YALE & TOWNE MFG CO.

[When we first saw some plumbers' fittings finished in magnetic oxide of iron, we made up our minds that when proper occasion offered we would "call for" some door furniture finished in the same way, and we are pleased to known we shall only have to go into the market for them, and not have to wait for them to be made to order. —EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

ARTESIAN WELLS IN NEW YORK CITY. — In a paper on the geology of Manhattan Island, read by Mr. James F. Kemp, before the New York Academy of Sciences, we find the following: Efforts have been made since the beginning of the century to obtain water from wells, both surface and artesian. Dr. Elwyn Waller informs me that over a thousand exist at present. Within the last ten or fifteen years, very many artesian wells have been sunk by the oil-well methods and the diamond drill. Many of the large breweries, malt houses and manufactories demand an abundant supply of water, and have found it advantageous to sink wells in preference to paying the city water-rate.

Sometimes they are successful in striking a wet spot and a good supply is obtained, but as there is no certainty from the nature of the formation, they quite as often yield very little. Still, the straitened capacity of reservoirs and the small head allowed consumers have greatly quickened the well industry. They are drilled by the methods perfected in the petroleum districts, and, indeed, one can hardly journey very far around the city without seeing the tall derrick and hearing the creak of the bull wheel and the thud of the drill. The wells are sunk by contract at from $6 to $12 per foot, the contractor fixing his price on his estimate of the hardness of the rock. Much difficulty is experienced on account of this varying hardness, as the drill tends to glance and make a crooked hole. Ordinarily the progress is 20 feet in 24 hours. The drillers say they are obliged to go down from 400 to 1,000 feet to strike water. The following facts have been obtained by inquiring of the drillers, and may not be very exact :

	Feet.	Daily.
Schaefer's brewery	640	5,000 bbls.
63d Street malt-house	414	2,700 "
Third Avenue and 67th Street	1,250	10,000 gals.
Sixth Avenue and 59th Street	730	10,000 "
Field's Building, 1 Broadway	400	57,000 "
Foot 58th Street, Hudson River	700	Unsuccessful.
Municipal Gas Co., 11th and 45th, 2 wells	500 each	30–45,000 gals.
Tenth Avenue and 39th Street	468	40,000 "
West 41st Street, No. 529	585	20,000 "
Foot West 39th Street	550	90,000 "
Sterns, Third Avenue and 42d Street	600	8,000 "
11th Avenue and 48th Street	600	30,000 "

99th Street and Second Avenue, 7 wells, 38 feet each in drift, total of 216,000 gallons per day. — *The Sanitary Plumber.*

Why Building Operations Halted. — Mr. Corliss (the famous engine builder of Providence), not very long before his death, had occasion to build an addition to his manufactory — a big "L," for additional machinery. To prepare the foundation for this L, it was necessary to move a ledge of rock by blasting. The men to do the work on the addition had been employed and put on the payroll; the materials had been purchased and brought to the building, and the work of blasting had begun. The next morning Mr. Corliss passed by the place where work was proceeding, when the foreman in charge knowing his interest in pretty things, called him.

"See here, Mr. Corliss," said he, "here's a bird's nest that we've found, and that's got to go."

He showed the manufacturer a robin sitting upon a nest that had been built, fast and snug, in a crevice of the rock, among some bushes that grew there. The bird flew off her nest as the men came near, and showed five blue eggs that looked as if they had just been laid.

"Can we move that nest somewhere else?" asked Mr. Corliss.

"I'm afraid not, sir. We'd tear it to pieces getting it out, and it isn't at all likely that you could get the bird to go to sitting again anywhere else. We've got to go on, so we may as well rip it out and throw the eggs away."

"No," said Corliss, "we wont disturb her. Let her bring out her brood right there."

"But we'll have to stop the work on the building."

"Let it stop then."

And so orders were given that operations on the addition should be suspended. They were suspended; and the hands stood still, drawing their pay for doing nothing, or next to nothing, while the robin sat on her nest with her air of great consequence and zealous attention to business, and had her food brought by her mate, and at last hatched her brood. And then there were three weeks more to go by, at the least, before the young ones could fly. Corliss visited the nest frequently, not with any uneasiness or impatience to have the robin and the young ones out of the way, but with a genuine interest in their growth. The old birds had all the time they wanted; and when at last they had sternly helped the clumsy, reluctant youngsters over the edge of the nest, and they showed themselves able to get about on their own hook, orders were given to resume the building operations; and the dull boom of the gunpowder tearing the rocks apart was heard where the birds had peeped. — *Boston Transcript.*

Automatic Accident Insurance. — The Employers Liability Company is about to introduce automatic ticket boxes for supplying accident insurance to the multitude. They are on the principle of the automatic weighing machines now so common; drop a nickel into the slot and out pops an accident insurance ticket that insures the holder for twenty-four hours against accidents, in the maximum sum of $500; ten nickels will yield ten tickets, aggregating $5,000 indemnity, which is the limit taken upon any one person. Suppose the chief engineer of a picnic crowd on an excursion barge should load himself up with a lot of these tickets, which are in blank; Some one of the picnickers falls overboard, or shoots out an eye, or breaks a leg; the chief engineer is promptly on hand with his accident tickets, fills in the name of the victim, collects the money from the company and divides with the injured individual or the heirs of the person drowned. Good speculation for the chief engineer. An investment of $1 a day by a speculator in accidents ought to yield "big money" in the course of a season. Possibly the company has surrounded the scheme with safeguards to prevent such speculations, but to "a man up a tree" they would seem to be possible. — *Spectator.*

A Curious Solar Clock. — A prominent watchmaker in Rio Janeiro has a solar clock fitted up in his establishment, which is not only ingenious, but practically solves the question of perpetual motion for those places where the sun shines perpetually. He has an electric bell apparatus in the upper story, and the two wires from the battery are furnished with a thin, flat, horizontal piece of metal, separated by a distance of four or five millimetres one from the other. Just above the flat piece of metal a biconvex lens concentrates the rays of the sun upon them at a certain moment, noon, for instance. The action of the sun's rays heats and bends the metal pieces so that they come in contact, thus closing the electric circuit, which rings the bell. This is not all however, that Mr. Moquin requires of the sun; he forces it to wind up the clock in his own room at the same time. The barrel arbor carries a click and a ratchet, which is wound up by the hammer of the electric bell as it moves backward and forward, striking the hour. And even this is not all, the sun has to regulate the clock also. The canon carries a washer with an indentation corresponding to adjusted lever, which is set in motion by the armature of magnet, and at noon turns the canon so as to bring the minute hand on the figure XII. — *Jewellers' Review.*

The Pilgrim Monument at Plymouth. — The last work on the national monument to the Pilgrims will be the carving of the marble tablet representing the treaty with Massasoit. The Statue of Liberty, and its accompanying panel, the Landing of the Pilgrims, is completed, and four men are busy cutting the Statue of Law. The model in clay of the panel representing the treaty is finished, and a photograph of it has been received by the committee on the monument for their approval. This photograph has been shown to us, and is an exceedingly artistic representation of so interesting an event in Pilgrim history. The scene is laid in the "common house," three sides of which are seen with their well-fitted logs, and the roof covered with thatch. In the middle of the room a common table is placed, at which on the right are seated Governor Carver and William Bradford, behind whom stand Myles Standish and three musketeers, and a drummer and trumpeter, with a drum on the floor. On the left Massasoit and three Indians are seated, with two other Indians and two muskeeters standing behind them. In the rear of the table, between Carver and Massasoit, Squanto is seen in a standing attitude, interpreting to Massasoit and receiving his replies. The grouping of the panel is exceedingly fine, and the faces of both the English and the Indians are drawn with conscientious skill. Mr. Mahoney, the sculptor in both the statues and panels, has shown himself a master of his art. — *Old Colony Memorial.*

TRADE SURVEYS

The last half of the year makes its bow to the commercial and manufacturing world, under conditions which promise a general improvement. The most noticeable features of the past six months have been the steady decline in prices in all channels of trade and industry, the declining volume of business, the increasing abundance of money, the declining activity in railway-construction and unfavorable balance of foreign trade. These influences have not been productive of any decided harm thus far, but they warn the producing interests generally that they must avoid any overproduction, and preserve harmony between production and distribution. In a general way, this is done; scarcely any mistakes have been made. Those controlling money have been very conservative, farseeing and prudent; if any mistakes have been made, they have been on the side of a too great conservatism. The financial management in business affairs have been far above that of recent years; greater prudence has been observed in all directions, from railway management down to the conduct of individual affairs. A goodly number of firms and corporations have started into business during the past six months, but they start well equipped with capital and experience, and so far as their operations have gone, they have been characterized by good sense, and a clear comprehension of business needs. Everything that has been done in the great industries, has been done wisely. A sort of expansion has been going on all the time in capital, and in facilities for cheaper production; but when it is looked into, such expansion is found to be in right directions. The cost of production has been declining, not only through competition, but through more effective and economic means and methods. The declining tendency, so far as it has been due to competition, is being gradually brought under control. Railroad rates are steadily declining. Competition is still very active in railway circles, from Maine to Texas. There are rumors of railway wars, but it is not necessary that the conflict between railroad systems should assume the magnitude of wars, in order to be productive of good. There is nothing that is likely to obstruct this contest; and in the long run, it will be productive of good, not only to shippers and the public at large, but to railway properties themselves. It is not likely that much new construction will be undertaken this year, although there is an abundance of capital awaiting a favorable opportunity to inaugurate very extensive enterprises, not only for traffic, but for the development of territory to be penetrated. In fact, this is one of the important points that will direct and control railway-construction for the next few years. The improvement of property will constitute the strongest inducement for construction. There are some 2,000 miles of railroad now projected in the West and Southwest, the construction of which will be pushed with a view, primarily, to the sale of land to be irrigated, mines to be developed and agricultural regions to be brought within reach of the husbandman. It is useless for writers with drooping spirits to say that railway-building has reached its limit for years to come, and that when it revives it will be within very narrow limits. There are grander opportunities now, than ever before for railway-building enterprise; capital and enterprise appreciate this, and will act upon it in the near future. Advices from a number of our leading builders and architects throughout the West, do not altogether harmonize as to the building probabilities for the coming six months. In three or four of the larger cities, the reports are not of an encouraging character; but from a number of smaller cities and towns, a better condition of things is reported. The industries are rearranging themselves; and in this rearrangement a good deal of work is being developed. It is safe to say, as it has been repeatedly stated, that house-building will be actively prosecuted in all sections of the country. The iron-makers' conflict in Western Pennsylvania will not likely be prolonged. The employers are very anxious to rid themselves of the iron grip of the Amalgamated Association, but can hardly do so. Builders will continue to pay existing rates of wages, to the close of the season. Wages generally will not be seriously disturbed in skilled directions; common labor has declined ten per cent within thirty days. The tariff agitation promises to be the great issue between the two parties; but it is one which is scarcely sincere. Reductions are certain to be made, no matter which party secures control of the Government. Public opinion seems to be decidedly in favor of them, and the best interests of all concerned will likely be subserved by advancing as gently as possible in the direction of lower duties, so as not to interfere with a healthy industrial activity.

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The American Architect and Building News

ADVERTISERS' TRADE SUPPLEMENT.

No. 73. SATURDAY, JULY 7, 1888. Volume XXIV. No. 654.

MODERN HEATING.

Father Time as he journeys on his weary way in the twilight of this 19th century might well be surprised at the progress the world is making in every sinew of its industrial structure, and stop and wonder how and why we mysterious and active people are so different and more practical and less romantic than our predecessors were of a century ago.

Why do we want to change so wonderfully and rapidly, he asks? Why not be content with the good days of long ago? He would have us grow more in the way of Shakespeare's description of us as mere players on the World's stage. With our exits and entrances, advancing our growth in life from the infant to the soldier "seeking the bubble Reputation at the cannon's mouth," and not advancing into civilization and enlightenment as we would and must have it. Reputation in a peaceful and industrious manner, protecting ourselves when necessary by Brotherhoods, Labor and Trades Unions when properly managed and under right-minded leaders, against the monopoly of Trusts and the concentration of Capital of nowadays.

In this enlightened century as the rising generation grow in civilization, and progress in social reforms and life, they feel that they must bend all their energies and thought with each other to provide more to the comfort, welfare and happiness of the home, and have the convenience and ease of travel as a luxury, and true we do find that the home is showing the touch of the hand of Dame Progress in our crowded cities. Houses are being built side by side in as friendly a way as space will allow. All down the ages, home above everything else has commanded first our best and most sincere attention. Travel may be a pleasure to most of people with all its modern advantages, but as the poet well puts it,

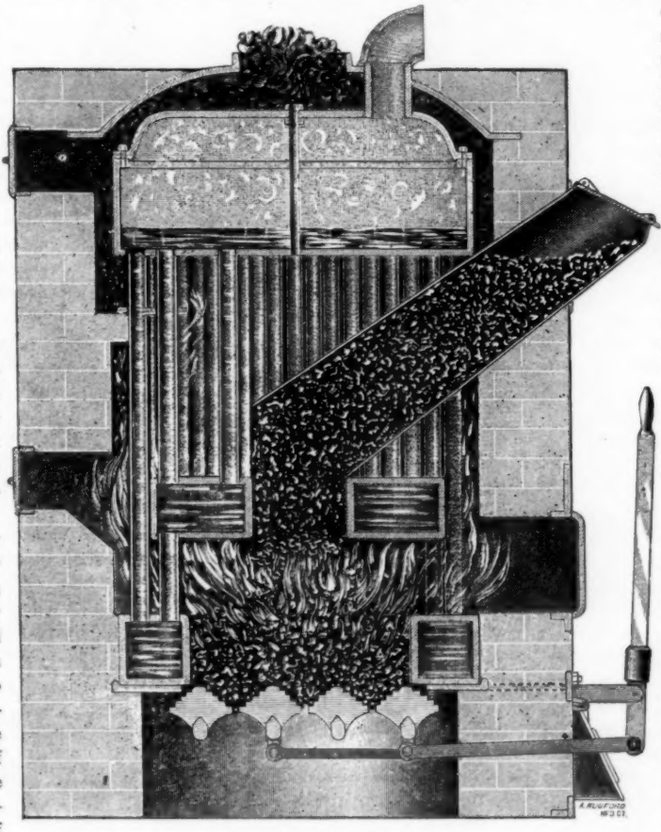
> "Whatever realms to see where'er we roam,
> Our first best country is at home."

As to its architecture, this country has been making great progress within the last five years. Much of it has been pretentious and peculiarly vulgar and out of place. But it has begun now to show artistic features of a very high order. The best specimens are scholarly and refined in detail. We hope this reformation will continue.

This country is particularly severe in its winter seasons, with its snow and wind storms which come to us unawares oftentimes. Necessarily we must make ample and safe arrangements for such trying contingencies.

Scientific men tell us that as an agent for heating homes steam is the best factor. The natural laws governing the generation of steam, the absorption of the heat of the fire by the water, its conversion into steam, its transmission of this heat mysteriously hidden in the vaporous mass to the various apartments of the home, there to give off this heat by condensation in radiators reconverting it into water, returns to its heater whence it first came only to continually repeat the process.

Prof. B. Silliman of Yale College, says: Water passing into vapor absorbs nearly six times as much heat as is required to raise it from 32° to 212°. This increase would render a solid body red hot by daylight, and still the steam produced by it has only 212° of sensible heat. Thus it is shown that the use of steam as the agent for heating is no longer an experiment, but is accepted by the public as the most healthful and agreeable agent now in use. To prove to you its popularity especially in New York City, where so many blocks of homes and stores are being erected every year, uptown and at its suburbs, we need merely to mention that Messrs. Clapp & Barron, New York agents for the Bronson Steam Heater, made by the Weston Engine Co., of Painted Post, N. Y., have just closed with a large contract to steam heat twenty-two apartment-houses uptown, New York. The contract distinctly says that none but this well-known "Improved Bronson," must be used in every house. The manufacturers of this heater are well-known and representative business men of Western New York, a firm of a well-deserved reputation and highly respected for their integrity in every detail in the business world. They have facilities which are unequalled for producing heaters in large and small orders promptly, and always prepared for any demand in this line. Their New York representatives are active and pushing business young men, and are in a position to provide for the comfort and happiness of the many and crowding homes now being erected within their jurisdiction. We commend them to your favorable consideration. They always take pleasure in answering inquiries, and will make plans, specifications and estimates free of cost to all parties sending them dimensions of the buildings they wish heated.



The Bronson Steam Heater.

Weston Engine Co.,
Painted Post, N. Y.

Haines, Jones & Cadbury, manufacturers of Plumbers' Supplies, Philadelphia, Pa., have lately built extensive additions to their factories. They have now a wood-working department for the manufacture of Wash-

stands, Tub-casings, Closet-seats, etc. They have put in new and improved machinery and employ only the most experienced and competent workmen. This enables them to turn out good work at a small cost. Their magnificent show-rooms are well worth seeing, being filled with sanitary appliances of the highest order. Four complete Bath-rooms are fitted up, one with a Copper Tub, one Enameled-iron, another Tile and another with an all-Porcelain Tub. Each is perfect in its way. The closets manufactured by this firm are well and favorably known in every section of the country. Among some new and ornamental closets are the Embossed Electric, Wyoming, Buffalo. They are all "Washouts" and every one sent out is warranted to be perfect.

THE "TIMBY" BURGLAR-PROOF SASH-LOCK AND VENTILATOR.

Among the unique things that have of late been put on the market nothing is more valuable, comparatively, in the line of house building than the Timby Sash-Lock and Ventilator.

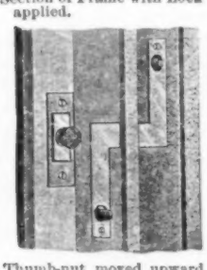
This device is not only novel, but quite effective for its intended purpose. It is designed to be set into the window frame, the centre of the lock in line with the centre of the meeting-rails of the sash, and is operated by means of a sliding thumb-nut on a face-plate attached to the inside stop. This lock is very simple in construction, easily operated, strong and durable, and automatically locks either or both sashes in any position desired, thereby affording the means of perfect ventilation, and at the same time perfect security against sneak-thieves. A locking device in the thumb-nut prevents the possibility of manipulating the lock from the outside when windows are left open for ventilation. The lock, therefore, accomplishes the double duty of affording at once security against forcible entry and ventilation to any degree that may be desired. It can be applied to any window, as it adjusts itself to varying thicknesses of sash or inside stops, and does not interfere with applying weather-strips or inside blinds.

Fig. 1.
Back View of Lock and operating device.

Thumb-nut moved upward and bolt thrown back same as in Fig. 2.

The accompanying illustration shows a section of window frame with the lock applied, with the thumb-nut moved upward, releasing the upper sash—the cut being semi-transparent, to show the inner construction of the lock, actuating spring, etc. The bolts are made from the best malleable iron, the case from wrought-steel, the face-plates and thumb-nuts from brass and bronze metal, highly polished and lacquered, presenting a very handsome appearance when applied. There seems to be nothing about the construction or operation of this device to render it liable to become disarranged; it should be very durable, and must form a very substantial and desirable lock, affording much greater security and convenience than the centre sash devices in common use. The circular of the manufacturers gives full and explicit directions for applying and operating, so that no difficulty will be experienced in attaching them. The device seems to have much merit, and we commend it to the notice of our readers.

Fig. 2.
Section of Frame with Lock applied.

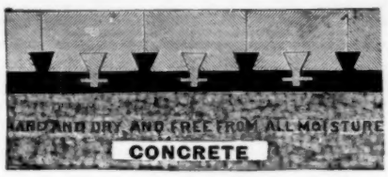


Thumb-nut moved upward releasing upper sash.

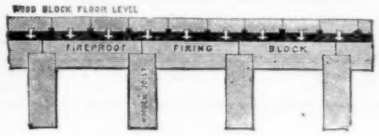
JENKINS & TIMBY,
Oswego, N. Y.

The "Timby" Burglar-proof Sash-lock.

NIGHTINGALE FLOOR SPECIALTIES.



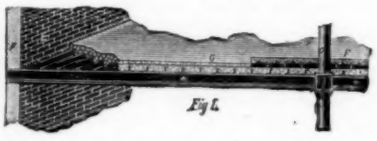
The above is a section of the Nightingale Wood-Block Tiling Floor which has now been on the Market here fifteen months. It is being extensively specified by architects in different parts of the United States, especially for fireproof buildings for which it is particularly adapted, being a means of obtaining a wooden floor over such without the use of sleepers of any kind, the decay of which so frequently causes annoyance. By this system a thoroughly solid, immovable and noiseless floor is obtained, free from dry-rot and dampness and perfectly watertight, there being no space underneath or between the joints of the blocks for the harboring of dust and vermin. The weight on the floor is better distributed, consequently it wears evenly. When concrete is employed for basement floors, the Nightingale floor as a covering for same is just the thing for preventing dampness (which is so often complained of) and making a thoroughly dry and warm floor with a pleasing appearance and dispensing with the wooden sleepers usually laid to nail the finished floor to. The foundation of Cement Concrete is allowed to become *hard* and *dry* and *free from all moisture*, before the flooring blocks forming the floor are placed in position over same, each being bedded in a specially made Antiseptic and adhesive Composition which takes up and enters into the undercut grooves on the sides and ends of the blocks, and thus forms a hard and fast joint-binding them to each other and the Concrete foundation making it a matter of impossibility for them to be lifted without the aid of a hammer and chisel, and not even then without destroying the blocks. The Composition also prevents dry-rot and dampness. Several millions of feet of this floor have been laid during the last few years under Mr. Nightingale's supervision in England and Ireland, in places where parquet tiles and marble floorings are often laid, the advantages over such being its noiselessness, solidity, warmth, and the doing away of chipping, cracking, and working loose of the floor from the foundation. The floor is in in use the following buildings, and up to the time of writing it has been specified for use in *forty-six* other buildings in various places: Royal Arcanum Club, Brooklyn; Dr.



Brewster's House, Brooklyn; Dr. Wunderlich's House, Brooklyn; Lawyer Keogh's House, New Rochelle; Niagara Insurance Offices, New York; The Jessup Mansion, Spring Lake; Mr. Montgomery's House, Parkville; Mrs. Eames's House, Fordham; Robbins Island Club-House; Belvedere Hotel, New York; Masonic Club, Brooklyn; Western Union Telegraph Building, New York.

Section above shows a system of making a fireproof, immovable, solid and noiseless floor over wooden beams or joists, doing away with the rough boarded floor, also dispensing with all kinds of deafening, pugging, beam-linings, fitting in of wet concrete between beams, and the like methods of an unsanitary and destructive nature usually adopted. The fireproof fixing blocks are very light being composed of coal-ashes, cinders, plaster-of-Paris and lime. They are moulded to shape and are hard and dry and free from all moisture before leaving the factory and before being placed in position over or between the wooden beams. This saves caulking and like methods adopted and is indispensable to all who are and have been troubled and put to great expense by leaky floors. A perfectly level and well bonded floor is formed, strong and durable in all its parts, one solid compact mass. For a cheap, strong and lasting floor possessing the above advantage it has no equal yet placed before the public.

FIRE AND SOUND PROOF FLOORS.



A is the main girder resting on wall E and on pillar D.
B are the small iron joists resting on main girder A and on wall at other end.
C the iron joists B bedded in concrete and forming both floor and flat ceiling.
F shows a portion of the floor C laid with patent solid and noiseless Wood Block Tiles.

Section showing Flat Fireproof Construction where iron joists rest on bottom flange of main girder and in which all iron work is entirely protected from fire.

The illustrations above give a general idea

of what is known as "Nightingale's Flat Concrete Construction," which is in use in hundreds of works, mills, mansions, barracks, factories, stores, banks, flats, offices, etc., in England. Small 3-inch by 1½-inch rolled-iron joists weighing about 5 pounds to the foot are fixed about 18 inches apart (forming a kind of network) and bedded in the concrete, resting at each end upon walls or girders as the case may be. The cement concrete is 5½ inches thick, including ½ inch of cement floating to a true level (which is allowed to consolidate and become hard and entirely free from all moisture) upon which rests the thoroughly seasoned wood-block tiles after being prepared in a special manner, each being bedded in a damp-proof adhesive and preservative composition, thus avoiding sleepers of all kinds and rendering the floor a solid, immovable mass into which neither fire, water, dust, rats nor vermin can possibly penetrate. This makes the floor fireproof both above and below. This system of fireproofing has been found to be economical, easy of adaptation and possessing great strength, rigidity and highly fireproof character. The floor is constructed so that it is entirely in one mass, consequently it is almost wholly free from lateral pressure. No thrust is transmitted to the walls, the walls being tied in and strengthened. It has been subjected at various times to severe tests, and has been accepted by the Insurance Companies on account of its fireproof qualities. It has been very thoroughly tested as to its sound-proof qualities acting towards sound as a brick wall towards sunlight and is therefore of the greatest utility in all public buildings. No better test could be given than a school-room for boys over a lecture or meeting room, and yet in cases where this system is in use, those in the lower lecture-room are absolutely ignorant of when or how the boys leave the room above. These advantages are of paramount importance not only in public buildings and offices, but also in apartment-houses.

The firm's name and address is the

NIGHTINGALE FLOOR IMPROVEMENT CO.,
151 BROADWAY, NEW YORK.

THE steam plant which is to be erected by the Ball Engine Company of Erie, Pa., at Union City, Ind., is nearly completed, and it is the purpose of the local company to get everything in readiness so that they can illuminate their city on the 4th of July. The Electric Light Company at Trinidad, Colo., have met with such pronounced success that they have found it necessary to increase their capacity, and to this end have ordered another engine from the Ball Engine Company, of Erie, Pa. The Paterson Electric Light Company of Paterson, N. J., have their building nearly completed. The system to be used is that of the Thomson & Houston Company, of Boston, Mass., and will be the finest equipped station in the United States; the steam-plant consists of five 125 horse-power engines, which will be erected complete in every detail by the Ball Engine Company, of Erie, Pa. The city of Rome, Ga., will be lighted with electricity; the Thomson & Houston Company, will furnish the electrical apparatus and the Ball Engine Company of Erie, Pa., has been awarded the contract for one of their celebrated steam-plants. The Ball Engine Company of Erie, Pa., has been awarded the contract for furnishing power for the Atlantic City Electric Light Company of Atlantic City, N. J. The Ball Engine Company of Erie, Pa., will furnish engines for the Newark & Schuyler Electric Light Company of Newark, N. J. A large plant will be erected by the Ball Engine Company of Erie, Pa., to operate the Thomson & Houston system of arc lighting for the City Gas-Light Company of Norfolk, Va.

BALL ENGINE COMPANY,
ERIE, PA.,

NOTES.

A RECENT issue of the *Scientific American* contained an exhaustive description with numerous illustrations of the works and manner of construction of the Gorton Boiler, manufactured by the Gorton and Lidgerwood Company, which is now so popular for house heating purposes.

THE Chrome Steel Works, Brooklyn, N. Y., manufacturers of the celebrated Chrome Steel now used extensively throughout the country, warn bankers and others engaging in vault and safe work to insert in their contracts: "Chrome Steel and Iron 5-ply manufactured by the Chrome Steel Works of Brooklyn, N. Y.," and then call upon them to furnish a certificate stating that they have supplied the successful bidder for their work, with their material, as there are several cheap imitations of Chrome steel which safe makers and others are persuaded to buy, because they can buy them at a less price than the genuine Chrome Steel. These imitations are of course represented to be equal to the genuine article, which they are not, lacking like all counterfeits the peculiar and remarkable qualities of the genuine.

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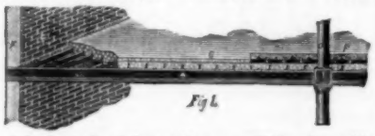

Fig. 1.

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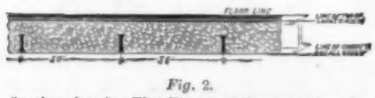
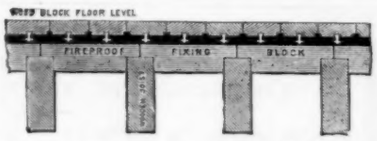


Fig. 2.

Section showing Flat Fireproof Construction where iron joists reston bottom flange of main girder and in which all ironwork is entirely protected from fire.



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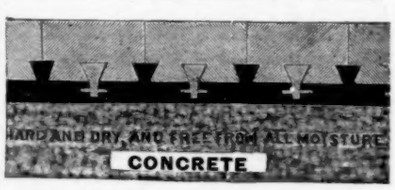

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